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by MURRAY WEISS

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THE SUBURBAN SPRAWLER

Relationships and Stuff

BY BETTY JO BUMPERSHOOT

Dear "Looking for Love:" I know how hard it is to find a decent man these days, much less a decent man who's environmentally conscious. Here's a tip: Whenever you're out and about, carry an issue of "GARBAGE" magazine with you. It's sure to attract the attention of a man who shares the same keen interest in

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But we can't do it alone. Achieving greater paper recycling levels will depend on the cooperation of government, businesses and millions of American citizens.

The U.S. paper industry will be there to assist every step of the way. We're developing a number of educational tools and awards programs to promote efficient source separation. We're also compiling a national database to help communities that want to start recycling programs identify waste paper dealers and mills that can use recovered

materials to make new products.

America's paper producers would like everyone to get involved in recycling. Because working together, we can make recycling an increasingly effective tool in municipal solid waste management.

PAPER

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This message is sponsored by the American Paper Institute, Inc., the national trade association of the U.S. pulp, paper and paperboard industry. For more information about paper recycling and other effective approaches to solid waste management, write API at 1250 Connecticut Avenue, NW, Suite 210, Washington, DC 20036 or call (202) 463-2420.

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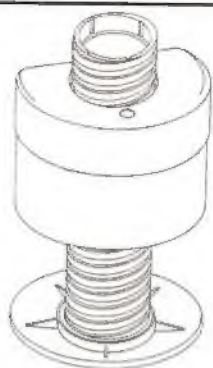
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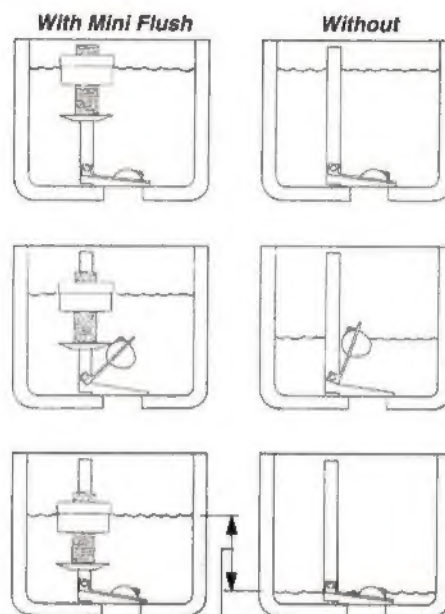
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Talk Talk Talk Talk Talk

Threats and warnings and poetry and tears. So much has been said about the environment, you'd think we'd have every problem solved by now. All the attention must mean something's finally being done.

Yeah? Though this is the wealthiest of countries, threat of a recession was enough to defeat every major environmental initiative in the November elections.

Or was it the recession? From my vantage point, trying to put out a magazine, it seems the vote may have been against confusion more than against the environment. This field is at war with itself. For example, we have a hard time trying to find unbiased writers, or information untainted by a political posture. The right people, stuck on opposite sides of the fence, still don't communicate with each other. Proposed legislation is complex, compromised, and convoluted. "Plant a tree, cool the globe" and "ban Styrofoam" have probably outlived their usefulness as rallying slogans and have already become dangerously simplistic. No wonder the public can't be rallied.

The truth is, most of the people in this country still don't know what global warming is. Most of the people in the world are by necessity more concerned with basic needs than with environmental stewardship. More to my point, there are even people working in this suddenly hip field who are woefully lacking in understanding. Some true stories:

- A television reporter who regularly covers environmental news asked me if the warm week we were having was due to global warming. As if that weren't naive in itself, she then went on to say that global warming probably wouldn't be so bad — spring weather around Thanksgiving was kind of nice.

- A former writer for **GARBAGE** declined to interview the manufacturers in question (to get the industry viewpoint) for an article, although she had quoted environmentalists and FDA muckrakers at length. Her reasoning when an editor noted the oversight? "Why bother — I know what they'd say anyway." (This environmental journalist has years' experience and a couple of book contracts to her name.)

- An earnest reader writes to condemn our publishing Dr. Rathje's piece on the history of garbage (Sep/Oct 1990), calling him a "media darling" who is in service to the plastics industry. The assumption inherent in such criticism? That there is a line between the two sides, not to be crossed.

Dr. Rathje becomes a target because he tells what he feels is the truth even if it isn't the party line. But Dr. Rathje remains popular. The media loves him and industry quotes him for the same reasons we do: His "garbology" work is unique, and his findings are intriguing. Too few scientists in this field dominated by missionaries are out there presenting the facts. Too few people writing in the field have his perspective and humor. Too few environmentalists are willing to risk their reputations by taking industry contracts.

But I want to know: What good does it do for environmentalists to keep the company only of other environmentalists? I believe that's called preaching to the converted. Comforting if you're in, but it could hardly be called working within the system to change the world.

Let me head off the criticism that I'm attacking my own soulmates. The majority of people who are at the top of the environmental field — be they scientists, educators, lobbyists, or waste managers — must be respected for their knowledge, their commitment, and their perspective. I am, rather, challenging the under layers: the club's vocal minority. The people who have become blind to others' viewpoints and even to scientific evidence.

The screech of those zealots, heard loud and clear even in this office of an independent magazine, is beginning to wear on me like the car horns in New York. Stop honking, for God's sake, and listen up.

GARBAGE won't have all the answers. But we will keep asking questions, and both sides will have the floor.

Patricia Poore
Editor



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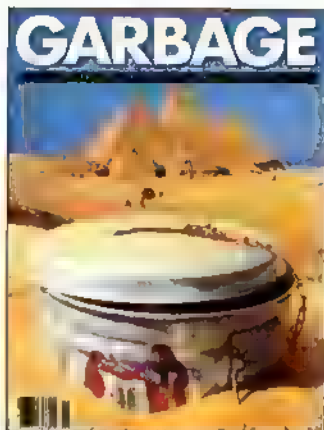
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HISTORY LESSONS

In "The History of Garbage" (Sept./Oct. '90), William Rathje concludes that "Americans are not suddenly producing more garbage. On a per-capita basis our record is, at worst, one of relative stability." He thinks that while the make-up of garbage has changed over time, the average weight of garbage disposed annually per capita has not.

He has left two common forms of garbage out of the equation: surrogate garbage and remote garbage.

Coal ash is a perfect ex-

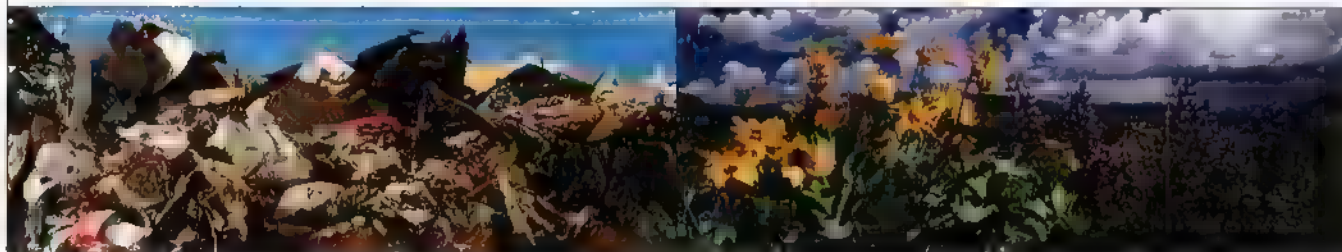
ample of surrogate garbage. It's still produced in huge amounts by coal-fired electric plants, but we now pay someone else to discard it for us. Dining out is an example of remote garbage. Compared to 1900, how many pounds of restaurant-related garbage per capita do we now throw away annually?

As long as surrogate and remote garbage are excluded from per-capita inventories, the "accurate, objective, scientific data" Dr. Rathje deems essential will simply not be available.

Jim Mueller
Joplin, Mo.

"Remote" refuse from dining out is included in the per-capita figures I used from Franklin Associates and others. You are correct that nowadays the coal ash from electric plants is not included in such estimates. I still believe we should relax from our current "municipal garbage crisis" mindset for two reasons. 1: Mistakes can be made when policy planners react to a crisis without obtaining basic information. 2: Municipal solid waste — the garbage that goes to the landfills — represents only seven percent of the solid wastes the U.S. discards every year. If you want a crisis, focus on the 93 percent (your "sur-

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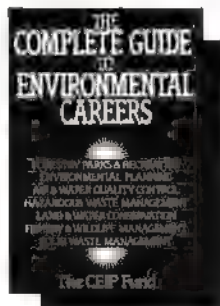
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rogate" wastes) from agriculture, mines, private industry, and power plants. Where does all that stuff end up?

— W.C. Rathje, Professor,
Dept. of Anthropology/
Director, the Garbage
Project, Univ. of Arizona

It was disturbing to see you passing off the writing of the ubiquitous William C. Rathje as the gospel. This man, the darling of television and so-called news magazines, is funded by the paper industry and the plastics industry, among others.

Margaret K. Wilt
Prospect, Tenn.

The scientific research conducted by the Garbage Project has been funded by both the

paper and plastics industries. Our refuse research has also been funded (to a much greater degree) by the National Science Foundation, the Environmental Protection Agency, and a wide range of similar entities. I have never been a paid consultant to the plastics industry, but they, and everyone else, are free to use our data. For 17 years, the Garbage Project's goal has been to provide accurate, objective information to anyone who says they want to base their actions on facts rather than fantasies. Of course, one thing we cannot do is make people accept the facts when they are presented.

— W.C. Rathje

Nothing in **GARBAGE** is the gospel.
— P. Poore

NOXIOUS NATURALS

I enjoyed your article on mycotoxins in the September/October '90 issue of **GARBAGE**. It is a very difficult concept to get across to people, how dangerous these mycotoxins are. Part of their danger lies in the fact that the symptoms from them can actually mimic any symptom that a person has from chemical hypersensitivity.

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epoxides — chemicals that can damage the DNA — sometimes creating the message to start a cancer.

Sherry A. Rogers, M.D.,
F.A.C.A.I.
Syracuse, N.Y.

WASTE-TO-ENERGY VS. RECYCLING

The article, "Cities Fight for Right to Recycle" in the September/October '90 issue of **GARBAGE** made several suppositions about the Hempstead, N.Y., waste-to-energy facility and its impact on recycling. These suppositions have not been borne out in actual experience. The article asserted that Hempstead would have to import waste if reduction and re-

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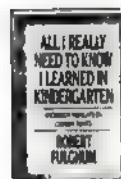
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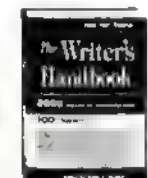
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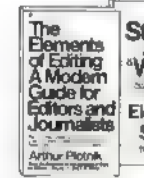
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cycling were to bring its deliverable quantities below 540,000 tons per year. This is not true. The Town never agreed to supply any amount of waste. The Town replaces only the tipping fee (less than \$30) for each ton less than 540,000. The larger loss — the reduced electricity — is handled by American Ref-Fuel at its own risk.

*Clifford Jessberger
Vice Chairman
American Ref-Fuel
Houston, Texas*

Under the agreement, out-of-town garbage can be, and routinely is, imported to Hempstead to make up for shortages. Furthermore, the \$30 tipping fee doesn't include ash disposal, which

Hempstead pays for no matter where garbage comes from.

— the editors

INVESTING IN WMI

Since 1980, it's true that eight local and unrelated collection subsidiaries out of more than 500 Waste Management subsidiaries have paid penalties involving alleged antitrust violations ["Environmental Investing," Sept./Oct. '90]. But it is important and only fair to inform your readers that several instances involved activity which predated Waste Management's ownership of the companies involved. No investigation has ever resulted in any finding of wrongdoing

by the parent company, and employees involved were promptly terminated or otherwise disciplined.

*Geri Powell
Mgr. of Media Relations
Waste Management, Inc.
Oak Brook, Ill.*

MEAT EATING

GARBAGE makes no mention of the devastating effect that meat consumption has on the environment. What's the point in a person recycling five or six paper grocery sacks, if by eating one hamburger, he destroys 55 square feet of forest? Why bother with a new toilet that saves two gallons of water per flush, if by eating meat, a person uses an additional 1,423,500

gallons a year?

Yes, recycling grocery bags and household garbage is worthwhile, but it is the proverbial drop in the bucket compared to what could be saved if people cut back on their meat consumption.

*Sara George
Vancouver, Wash.
(Statistics from
Vegetarian Times,
April, 1990)*

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TOM ROSENTHAL

John Reid in his Bioshelter, with a tasty and non-polluting tilapia.

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PROFILE

John Reid leans over a tank filled with 5,000 gallons of fresh water and nets a sampling of tilapia — the orange-scaled fish he raises. Each week, Reid's Bioshelters, Inc., a fish farm enclosed in a greenhouse, churns out 100 pounds of tilapia plus 140 cases of basil for restaurants and grocers in the Boston area.

Conventional fish farming, where fish are raised in either concrete-lined pools or nets submerged in deep ocean inlets, is often cited for its waste and inefficiency. Commonly farmed fish like trout and salmon are big eaters and big waste-makers. Each day, an average fish farm discharges millions of gallons of *untreated*, nitrogen-laden wastewater directly into the ocean, or a nearby lake or river. Fish feces and uneaten food spur plankton blooms that can kill marine life. There is no federal legislation regulating fish-industry effluent, and state regulations are often considered lax by environmentalists.

John Reid figured there had to be a better way to curb the pollution and waste. Bioshelters, Inc., is the result of five years of research into an innovative water-recycling technology first conceived at the New Alchemy Institute in Falmouth, Mass. Reid finessed and adapted the technology for a commercial scale.

At Bioshelters, contaminated water is diverted through bacteria-based filters that convert the poisonous ammonium and nitrite in fish waste into nitrate, a plant nutrient. Twenty percent of the cleansed water is routed to hydroponically grown basil. The remaining water is circulated back to the fish. While it may take years to produce market-ready salmon, tilapia can be harvested after six months. Demand for the delicately-flavored fish is so great that Reid is constructing two additional 14,000-gallon tanks, which will increase fish production to 700 pounds a week by this spring.

Reid's first foray into fish farming began during his freshman year at Hampshire College, when he moved into an apartment with an adjacent greenhouse. "I'd always been interested in alternative energy, so I installed large tanks of water [as a heating system] in the greenhouse," he explains. "Then I thought 'what can I do with all this water?' The answer was 'raise fish.'" With the help of some friends, Reid grew basil, broccoli, and other greens, and sold them to a local co-op. He also produced about 60 pounds of tilapia a year. Hampshire College was so impressed with the results that it helped Reid obtain an \$800,000 grant to

Wastes generated from fish farming are rerouted to fertilize plants.

build an on-campus "bioshelter" where he could continue his research.

In the present facility, water conservation and pollutant removal have given rise to other ecologically-sensitive farming techniques. Rather than dump the sludge that forms from fish waste trapped in the filters, Reid composts it, providing rich fertilizer to a neighboring market gardener. Because insecticides are a threat to fish, Reid employs natural pest controls to protect his basil from aphids and white flies. He's also created an island where flowering plants like impatiens and Queen Anne's lace attract wasps and other beneficial predators.

Reid believes bioshelter-style fish farming will become increasingly popular as world fish supplies become over-harvested. Three fish farms in the U.S. and Canada have already contracted with Reid to adopt the technology. It may also provide an economically viable alternative to grain-based diets in the Third World.

Is America really ready for a fish called tilapia? "There's unheard-of market potential here," beams Reid. "We now consume 15 pounds of fish per person per year — that's up from 10 pounds in 1980." Tilapia may not be a regular on the Julia Child show just yet, but as America grows ever more concerned about environmental issues, fish fresh from the greenhouse may become standard fare.

— *Ginia Bellafante*

Dig This Dump

Solid-waste engineers in Collier County, Fla., are debunking one of our newest environmental myths — that once it's buried in a landfill, garbage is forever. What's more, they're pioneering a new way for adding years to old dumps.

Research at places like the University of Arizona suggests that entombing trash in landfills drastically slows degradation. That may be true for landfills in the Southwest, where the arid climate prevents nutrients from reaching microorganisms that break down organic waste. But the theory doesn't hold water in the East, where comparably higher levels of rainfall (and snowfall) keep landfills moist and microbes feasting.

That observation led Robert Fahey, solid-waste director for Collier County, to reconsider the dump. Confronted with a rising waste stream (the county's garbage output has grown at a phenomenal 19 percent a year over the last eight years) and the public's dwindling tolerance for accepting new landfills, Mr. Fahey figured it was time to stop thinking of dumps as burial mounds. Why not, he reasoned, start thinking of ways to mine the dump and recycle the trash?

"The EPA basically has two rules for landfills — entomb the waste and leave it alone," says Mr. Fahey. "We're going a step further."

The mining concept is, well, groundbreaking because it lets landfills act as giant anaerobic digesters that degrade 80 percent of the garbage into compost that can be reused. But the process is pretty low-tech.

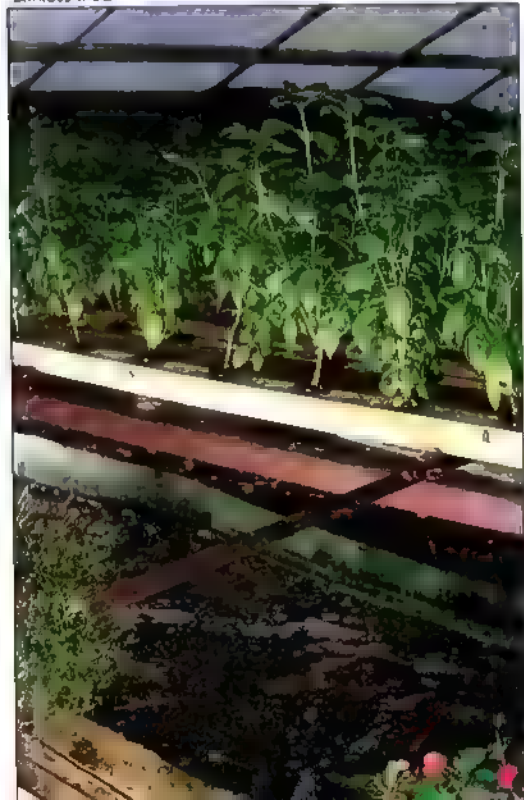
At the 300-acre landfill, a front-end loader bites into an 11-year-old section and dumps the trash onto a "grizzly bar," where large items like refrigerators and tires are "scalped" for recycling or reburial. Each hour, about 100 tons of the leftovers are fed by conveyor to a vibrating screen mesh with 2-1/2-inch openings. Non-degradable plas-

FOR THE RECORD

"Must We Save Every Secretary of Interior?"

Headline paraphrasing Interior Secretary Manuel Lujan's infamous comment on endangered species. (*Marine Conservation News*, Autumn, 1990)

TOM ROSENTHAL



FOR THE RECORD

**“... a two-ton truck ...
an inflatable woman and
a crab that had grown up
inside a bottle ...”**

A press release describing items found on the Center for Marine Conservation's annual beach clean-up.

tics, glass, rubber, and metal pass over the screen and fall onto a conveyor equipped with a drum magnet that removes ferrous metals for recycling. (A dealer buys the excavated scrap for \$10 a ton; plastics, glass, and aluminum are handpicked and stockpiled for future sale.) Degraded paper, yard waste, and other organics pass through the screen, and are reused to cover freshly dumped

garbage — thereby cutting annual expenditures for cover dirt (totaling \$275,000) by about \$100,000.

Exhuming the garbage for reuse also offers a chance to make the landfill environmentally sound. Like many old dumps, the bottom of the Collier landfill lacks a plastic liner, allowing rainwater to percolate down through the garbage — leaching pollutants directly into the water table. Yet once a portion of the dump has been excavated, engi-

neers can seal it before refilling it. Even in a modern, lined landfill, mining the garbage would enable engineers to check the liner for punctures.

One drawback: Mining the dump could expose a lode of hazardous material. So toxicity testing of the landfill and the exhumed material is critical. Collier County's economy relies primarily on tourism, not on manufacturing, so its landfill remains relatively free of hazardous garbage.

Toxics may limit widespread duplication of landfill mining. Nevertheless, the average landfill is designed for about a ten-year lifespan, so communities are continually on the lookout for new space to site new landfills — but who wants a dump in their backyard? Municipalities in New Hampshire, New York, Connecticut, Delaware, and Louisiana, convinced that recycling old landfills is a better alternative, are launching their own “landfill reclamation” projects.

“I can't see reclamation being generally applied as a panacea for all our landfills,” says Mr. Fahey. “But it certainly reduces the costs of continuing to use more land to build new landfills.” — Bill Breen

GARBAGE DICTIONARY

Fly tip, noun, verb. An import from London's Department of the Environment, it refers to illegal garbage dumping. The term — a derivative of the phrase “on the fly” — made its way across the Atlantic with John J. Doherty, deputy commissioner of operations for the New York City Department of Sanitation. Mr. Doherty went to London in 1989 to discuss both cities' problems with illegal dumping.

To avoid soaring carting fees, dumpers often make empty lots the final rusting place for their collected discards — old sofas, refrigerators, construction debris. The term “fly tip” may gain real popularity in New York, considering the new form garbage dumping is taking. Sometimes, trucks carrying mounds of trash will barrel down a lonely stretch of road and unload debris — without even stopping.

— Ginia Bellafante

• I Want My Hazardous Waste

In most neighborhoods, a hazardous-waste facility is about as welcome as an uninvited mother-in-law. Not so in San Francisco's Hunters Point. Here, some residents are fighting to prevent the city from closing H&H Ship Service, a 30-year-old ship-waste handler — even though the California Department of Health Services has cited the facility for 91 violations committed over the past three years. H&H treats bilge water, as well as used petroleum. Transgressions include improper waste labeling, inadequate record keeping, and malfunctioning employee showers and eyewashes.

At a public hearing last fall, approximately 200 people came out to support the facility. The reason? Approximately 500 jobs could be lost if H&H were to shut down. (Also, 60 to 70 percent of the firm is staffed by minorities.) The Department of Health Services will decide on renewing an H&H operating permit later this month.



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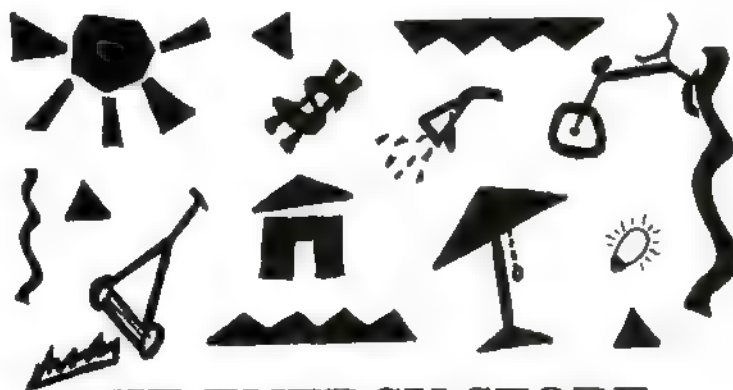
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FOR THE RECORD

“The University of California at Davis is trying to get rid of a freezer full of radioactive beagles.”

Headline about 1,000 dogs used by the DOE in radiation testing. (*San Francisco Bay Guardian*, Sept. 26, 1990)

•Paul Newman's All the Rage

Paul Newman's popularity is wilting in timber country. Over a year ago, the actor narrated Turner Broadcasting System's controversial documentary *Rage Over Trees*, which focused on efforts to save the

Pacific Northwest's dwindling old-growth forests from the loggers' chainsaws. The film's anti-logging stance infuriated 43 employees at Willamette Industries, a timber and paper company in Albany, Ore. They decided to make their voices heard. Their vehicle? An unofficial boycott of the local Burger King — a once favorite lunch spot — that features Newman's Own brand of salad dressings.

Suzanne Carlos, a saleswoman in Willamette's plywood division, believes the narrator was less than qualified to speak on the subject. “[The producers] flew Newman around in a helicopter and said, ‘look what they’re doing’ without explaining that paper prices are going to get out of hand if trees aren’t harvested.” Ms. Carlos claims that Willamette workers won’t return to the fast-food eatery until the Newman's Own product line is

pulled. Considering that Burger King uses paper for more than 90 percent of its packaging, the boycotters might better promote timber interests by beefing up — not cutting back — their visits to the burger joint.

•Paper Chase

At Bowling Green State University, paper cups are becoming as scarce as manual typewriters.

To help meet its 25-percent waste-reduction goal by this July, the university switched from paperware to glassware in its dining halls which serve 14,000 students daily. The change, inaugurated just over a year ago, brought an unanticipated bonus in these belt-tightening times. The university saved \$32,251 during the program's first 12 months (including the cost of water and detergent for washing the glasses). Why? Simply because glass is reusable. “We found



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that using glassware could actually save money, as well as support environmental concerns," says Jane Schimpf, the university's director of Food Operations.

So far, the switch to glass has saved 1,150,000 cups — equaling 26,450 pounds of garbage that otherwise would have been carted to the county landfill.

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"These plum tomatoes were treated with petroleum wax." That's the kind of straightforward labeling shoppers will find in the produce section at all three branches of the Sunset Foods supermarket chain in suburban Chicago. Sunset began posting specific information on the application of post-harvest chemicals about one year ago, after prodding from shoppers and the Illinois

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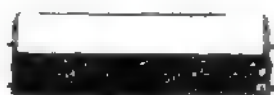
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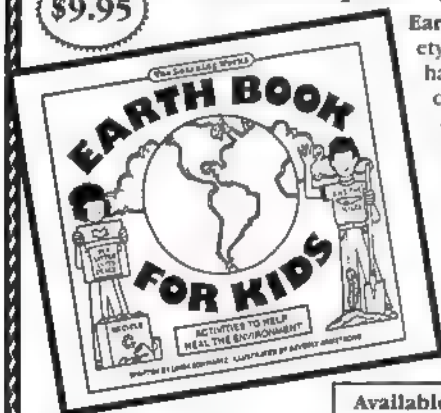
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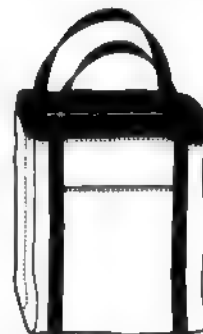
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FOR THE RECORD

"The environmental angle will be used, abused and flogged silly."

Bob Garfield, an *Advertising Age* editor, predicting an onslaught of misleading green claims. (*Advertising Age*, Oct. 22, 1990)

Coalition for Safe Food. While apples, peaches, and other fruits are sprayed, waxed, or fumigated with chemicals like methyl bromide and triforine to extend shelf life, the practice has come under fire by environmentalists. According to the National Coalition Against the Misuse of Pesticides, health risks associated with post-harvest chemicals include

cancer, nervous-system disorders, and birth defects.

The labeling program helps consumers make informed decisions in the marketplace with little cost or effort on the part of the supermarket. Workers at Sunset simply remove shipping-carton labels that identify the chemicals used in post-harvest treatment, and display them on store shelves. Sunset is one of the first supermarkets in the country to tell shoppers how their apples and oranges are treated after they're picked.

• Souper Combo Gets 86'd

Campbells' Souper Combo, the microwaveable soup-and-sandwich platter that OD'd on paper and plastic packaging [see "In the Dumpster," Sept/Oct 1989 — the edi-

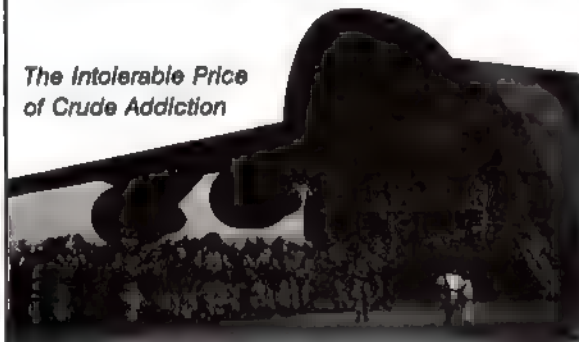
tors], has finally expired. Campbells is discontinuing the product, effective this month.

Containing 11.9 ounces of edibles and five separate layers of packaging, the Souper Combo went national over a year ago, just as consumers began to wake up to waste issues. The platter racked up \$62 million in sales between July 1989 and July 1990. But the numbers plummeted to \$6.8 million during last year's second quarter.

Campbells doesn't believe that excess plastic had anything to do with the Souper's sagging sales. "Environmental issues ... didn't impact on the success of the product," comments a Campbells spokeswoman. "The issue was one of changing financial objectives and increasing competition." Interestingly, competition comes primarily from ConAgra's Healthy Choice line of frozen microwaveable food, minimally packaged on a single LDPE tray covered with a plastic film.

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An aerial photograph of a large-scale solar farm. The image shows rows of dark, rectangular solar panels mounted on a grid of metal support structures. The panels are arranged in a perspective that leads towards the horizon. The sky above is a mix of blue and white, with soft, wispy clouds. The overall lighting suggests a bright, sunny day.

WHATEVER HAPPENED TO Solar?

**IN A QUIET
NEIGHBORHOOD IN
GARDNER, MASS.,
THE SUN IS RISING
ON A NEW ERA.**

Mounted on the roofs of 30 homes are solar cells enabling residents to draw up to half of their energy needs from the sun during some portions of the year. At high noon on a bright summer day, these rooftop "photovoltaic" systems have even generated enough power to help meet the electrical needs of neighboring residences.

The four-year-old Gardner experiment, underwritten by the New England Electric System, is not some abstract research project on where and how our grandchildren will generate their electricity. Solar-photovoltaic electricity remains three to five times as expensive as that generated by fossil fuels. Nevertheless, New England Electric and other utilities around the country are experimenting in

the belief that "PV" systems will be cost competitive in urban and suburban America by the end of this decade.

"I'm confident that, by the mid to late 1990s, you're going to be seeing [photovoltaic] systems on rooftops like you saw solar thermal [hot water] systems in the late 1970s," says Donald Fagnan of Philadelphia Electric Co., which is also studying residential solar-electric systems.

In another decade or so, your residential roof may be functioning as a solar-power plant. More than 10,000 miles from Boston and Philadelphia, the research and development center of Japan's Sanyo Energy Corp. features a rooftop layered with "solar shingles." Each shingle, about seven millimeters in thickness, has its own solar-electric cell that absorbs sunlight and generates electricity, which is stored in a battery. Sanyo officials say this product, which generates electricity for the entire

BY LOUIS PECK



"WHY BUILD CENTRAL POWER STATIONS?" SUCH VISIONS WERE INTERRUPTED BY THE POLITICAL VERSION OF AN ECLIPSE OF THE SUN: THE REAGAN ADMINISTRATION.

house, could be on the U.S. market within three years.

New England Electric, Philadelphia Electric, and Sanyo offer but three of a multitude of answers to the much-asked question: "Whatever happened to solar energy?" It was a favored child in the mid to late 1970s, as the federal government showered it with money and tax credits while the press and public oohed and aahed over its potential. But the 1980s were a time of troubled adolescence, as Ronald Reagan's budget makers turned off the cash spigot and a worldwide oil glut caused many Americans to lose interest.

Now, as the 1990s introduce a rising environmental consciousness and renewed concern about oil prices, the solar industry is bracing itself for rapid growth. Solar-photovoltaic products now account for about \$175 million in annual sales. Manufacturers say they will comprise a \$1 billion industry by the mid 1990s — and that they could reach \$2 billion by the turn of the century.

Steve Strong of Solar Design Associates in Harvard, Mass., says his clients "are typically your early market adapter, someone who has a

strong environmental commitment or a strong interest in high technology, cutting-edge stuff." He becomes mildly exasperated with the media's preoccupation with the current cost of solar, particularly photovoltaics.

"The price is certainly an issue, but the price is coming down steadily," Mr. Strong says. "The fact that the technology is here and that you can do this at all is of major significance."

While photovoltaics is receiving most of the attention, it's not the only solar technology experiencing growth. The solar hot-water industry, which was almost wiped out when federal tax credits for residential systems expired in the mid 1980s, is coming back. Products usually classified under the heading of "passive solar" or "solar-building technologies" also are gaining a solid foothold.

No one claims that, over the next decade, this most non-polluting of energy alternatives will significantly displace our dependence on domestic coal or foreign oil. While energy experts predict that solar and other "renewables" will provide about 20 percent of U.S. energy needs by the year 2000 — up from about 10 to 12



percent currently — growth will come mainly from biomass and geothermal energy, not direct solar. Rather, solar manufacturers and advocates say they are looking for "niche" markets where the technology makes economic as well as environmental sense.

Right now, it doesn't make much sense to pull your home off the utility grid — where you're probably paying in the range of six to nine cents per kilowatt hour during winter months

SOLAR POWER: HOW IT WORKS

Solar Electricity

This technology is formally known as *photovoltaics*, meaning "electricity from light." Each photovoltaic cell contains *semiconductor* materials. When sunlight strikes a cell, light energy called *photons* knocks loose electrons, creating *direct current*. These electrons are collected by metal contacts arranged into a small grid.

To increase power, cells are

wired together with other cells. Twenty or more cells are packaged under glass or plastic as a *module*. Groups of modules are then wired together to form an *array*.

In stand-alone systems — ranging from solar calculators to complex arrays providing lighting, water pumping, and refrigeration to remote villages — solar electricity is stored in a battery. In

systems connected to a utility grid, an *inverter* transforms the direct current produced by solar cells to *alternating current*, which is normal household current. In stand-alone systems, direct current can be used with 12-volt appliances. However, some of the more sophisticated stand-alone systems serving large vacation homes also use an inverter, enabling residents to use

standard appliances.

The semiconductor material used in solar cells is *silicon*. The most commonly applied technology is called *single crystalline silicon*. While the purity of this material allows electrons to flow freely and increases its efficiency, it's expensive from a manufacturing standpoint. *Poly-crystalline silicon* is less expensive because the silicon involved is less pure.

The *thin-film amorphous silicon*



Solar powered, solar warmed: solar works at this Mass. home.

vide electricity to boats, mobil homes, and remote cabins.

The retail price of a starter kit begins at \$1,000 and can go considerably higher, depending on the degree of comfort and convenience you desire. If you're mechanically inclined, Mr. Maycock says you can install your own system for as little as \$500. While the alternative — a diesel generator — can be bought for a fraction of the starter kit's price tag, Mr. Maycock adds, "A generator lasts for nine months before it needs maintenance, and sits there and burns up fuel and makes noise like you wouldn't believe."

Because photovoltaic systems produce direct current, the rapidly increasing sales of solar panels has spurred demand for numerous 12-volt appliances. Among big sellers are fluorescent lights that use about a quarter of the energy of a standard bulb, and refrigerators advertised as utilizing electricity ten times as efficiently as a standard model.

More sophisticated systems, which use inverters to transform direct current to alternating current, are becoming cost effective — even when there is a nearby utility distribution system. Steve Strong of Solar Design Assocs. is currently working on a large vacation home on Block Island that will use a PV system costing about \$30,000. However, Mr. Strong notes

— and install a photovoltaic system that will run upwards of \$40,000. However, there are a variety of solar-energy systems and products already on the market that will help cut your monthly energy bill.

Sunrise on Solar Electricity

Firms specializing in catalog sales report a sharp jump in what are generally known as solar-electric starter kits, which utilize

photovoltaics in locations that are far from existing utility lines. "Right now, the mainstream [consumer PV] market is the 40-watt panel that allows you to have two or three fluorescent lights and a television," says Paul Maycock, a leading solar-industry consultant and president of the Casanova, Va.-based Photovoltaic Energy Systems. Mr. Maycock estimates that about 30,000 such units were sold in the U.S. last year to pro-

technology involves placing very thin layers of silicon and other materials on a plate of glass, thereby creating an electric cell. Many in the industry believe that the cost effectiveness of this technology may make photovoltaics competitive with conventional sources of electricity. The problem is that amorphous silicon has so far proved only about half as efficient in producing solar electricity as its more expensive counterparts.

Commercially, single crys-

talline has averaged a 12- to 14-percent efficiency, as opposed to about six percent for amorphous silicon. In laboratory tests, some solar-cell technologies have achieved efficiencies as high as 38 percent — more than six times the efficiency of the photovoltaic cells developed by Bell Laboratories in the mid-1950s.

Solar Thermal

This technology covers both the solar water heaters found in

more than a million American homes, and the *parabolic trough* and *dish* technologies used to generate electricity. Solar hot-water systems generally include *flat plate collectors* mounted on either a roof or the ground, and oriented south. The other major element in the system is a tank that's large enough to hold one to three day's demand for hot water, depending on the number of solar collectors.

There are *active* and *passive*

systems. The active category includes a *pumped* system, whereby water from the storage tank is circulated and warmed through solar collectors, and pumped back to the tank. In the passive category is a *thermosiphon* system, in which the tank is mounted above the collectors. Hot water rises through piping to the tank as it's displaced by cold water sinking to the collector — the lowest point in the system. The system's advantage is that it doesn't

IN SAN DIEGO, SOLAR-ELECTRIC CELLS ARE NOW USED TO POWER CALLBOXES ON THE SAN DIEGO FREEWAY AS WELL AS TO PROVIDE IRRIGATION AT THE CITY'S FAMOUS ZOO.

this is significantly cheaper than the \$40,000 price tag for extending power lines to the house, to say nothing of paying the 35-cents-per-kilowatt-hour rate for power generated by the island's utility plant.

For the less committed, there are more modest ways to take advantage of photovoltaics. Outdoor lighting is one — there are now about 1.5 million solar lights sold annually in the U.S. Mr. Maycock estimates the market may be as large as 10 million. One item unveiled recently was a motion-detection light, which can be used for security purposes or to help you get inside your house when you're loaded with groceries. Solar-powered battery chargers also have proved popular in the boating and recreational-vehicle markets, where they can be used to keep a battery from running down between trips.

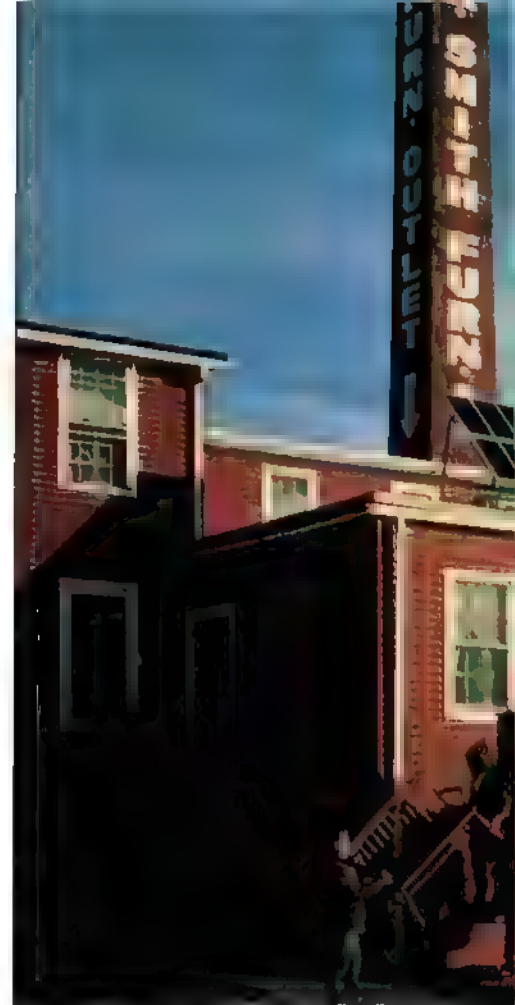
Solar Hot Water Freeze Out

About 1.2 million homes in the U.S. use solar hot-water systems, far outstripping the approximately 20,000 homes with solar electricity. But that still puts this country well behind its economic

archrival, Japan, where there are approximately 1.5 million solar hot-water systems in Tokyo alone. Prior to the demise of the federal tax credit for residential solar systems at the end of 1985, there were 40 to 50 firms manufacturing solar hot-water equipment. Today, there are barely half a dozen.

Like millions of other Americans, Scott Sklar, executive director of the Arlington, Va.-based Solar Energy Industries Assoc., took advantage of the 40-percent tax credit in 1985 to install a solar hot-water system in his home. He figures that the system paid for itself in four years, and now saves him \$40 a month (even though his previous hot-water system used relatively inexpensive natural gas). Mr. Sklar is a true believer in the cause for which he lobbies: Besides the solar hot-water system, his home features a solar-heated greenhouse and a solar-electric panel that powers several kitchen appliances — and also charges his electric car.

Even with the tax credit gone, there are several factors combining to make solar hot-water systems increasingly attractive. Prices are dropping. Some systems now retail for



just over \$2,000. Meanwhile, fossil-fuel prices and electric rates are rising. Asked what the Persian Gulf crisis has done for business, Peter Lowenthal, a Beltsville, Md., solar hot-water contractor, replies, "It's an affirmative. A lot of people are inquiring." Noting that it costs approximately \$500 a year to operate an electric hot-water boiler in the Washington, D.C., area, he adds, "When solar hot water is competing

require moving parts which can break down. Another form of passive hot-water heating is an *integral* system, in which an insulated tank of water is exposed directly to the sun. These are particularly common in the Sun Belt.

One new system, known as the "Copper Cricket," attempts to blend aspects of both active and passive systems. It uses a "geyser pump." As a methyl alcohol-based fluid boils, water is forced up the solar collector much in the

manner of a coffee percolator. It then flows down into the tank. This hybrid system allows a user to place flat plate collectors above the storage tank in the manner of an active system, but — like a passive system — it lacks moving parts.

Solar hot-water systems require backup heating during long periods of cloudiness or heavy hot-water use. Backup systems can operate on electricity, oil, natural gas, propane,

and even wood in some rural areas. If correctly sized, experts say that solar power should provide 70 to 80 percent of a home's hot-water needs.

Toll-Free Help

Solar appliances are generally not available at the local hardware store. At least not yet. But obtaining technical expertise or ascertaining what's on the market is but a toll-free phone call away.

National Appropriate Technology Assistance Service (NATAS), a non-profit organization, provides both technical and cost information on purchasing and installing solar systems. NATAS, U.S. Department of Energy, P.O. Box 2525, Butte, MT 59702-2525; (800) 428-2525; in Montana, (800) 428-1718.

Real Goods Trading Corp. claims to be the "largest mail-order distributor of alternative-

**Collectors on this
Gardner, Mass.,
factory pull energy
from the sun.**

Wisconsin's Solar Village

In the late 1970s, the small town of Soldiers Grove, Wis., became the first "solar village" in the U.S., adopting an ordinance requiring that 50 percent of all heat in the town's commercial establishments be derived from the sun.

Ed Herbst, owner of the local bar and grill, installed a solar hot-water system designed also to provide "radiant" heat. With this system, small tubing is installed in the floor, and the warm water — usually in the 90- to 110-degree Fahrenheit range — radiates heat into the room. Mr. Herbst paid about \$21,000 for his hot-water/heating system, adding: "We wrote that off in about five to six years, and figure anything from here on in is savings."

Herbst was one of a few business owners to install an active system. Most of the town's other 20 to 25 merchants have installed a variety of passive systems in order to comply with the ordinance. The cheese factory, which uses heat from the cheese-making process to warm its plant, got a waiver.

Nationwide, by some accounts, solar is most widely used for heating swimming pools. Water is pumped into black plastic collectors that collect heat and send warm water back into the pool, much as warm water will spout from a garden hose left sitting



MOBIL SOLAR ENERGY CORP.

against electricity, there's some real potential [for growth]."

In place of tax credits, some innovative forms of financing are making the purchase price of a solar hot-water system more attractive. The Eugene, Ore., utility is offering a \$300 rebate for customers who purchase solar hot-water systems, and a nearby electric cooperative is offering 12.5-percent financing up to \$5,000. Additionally, those taking out mort-

gages guaranteed by the Federal Housing Administration will now be able to include the cost of an industry-certified, solar hot-water system. "In 1991, this will have a profound impact," says Mr. Sklar. "The higher upfront costs can be amortized over 20 to 30 years. People will realize cash immediately. It may add \$15 to \$20 per month to the mortgage, but you'll be saving \$30 to \$40 per month in energy costs."

energy and energy-sensible products in the world." The Real Goods catalog is published three times a year; also ask about their *Alternative Energy Sourcebook*. Real Goods Trading Corp., 966-G Mazzioni St., Ukiah, CA 95482; (800) 762-7325.

Photocomm bills itself as the country's largest distributor of solar-electric systems. For a catalog, contact: Photocomm, Inc., 930 Idaho-

Maryland Rd., Grass Valley, CA 95945; (800) 544-6466.

Solar Energy Industries Association can tell you if the solar hot-water system you're eyeing has been cleared by the Solar Rating and Certification Corp., an eight-year-old entity consisting of state-government officials and industry representatives. Solar Energy Industries Association, 777 North Capitol St. N.E., Suite 805, Washington, D.C. 20002; (202) 408-0660.

Tax-Break Help

While the federal government's interest in solar energy has been waning, there's been progress at the state level. According to a NATAS survey, these states offer tax breaks to homeowners who buy solar equipment:

FLORIDA awards a tax break to those who make electrical power or energy for their own use. Solar-energy systems and components are exempt from

sales taxes and taxes on rental, use, distribution, and storage.

HAWAII provides an income-tax deduction for 40 percent of purchase and installation costs of an alternative-energy device. A 20-percent deduction is allowed for up to three years after that, with a maximum of \$5,000 in any one year.

INDIANA permits homeowners to deduct the value of a solar-energy system from their home's appraised value.

THE REAL REVOLUTION WILL OCCUR WHEN THE UTILITIES ARE GIVEN INCENTIVES TO INSTALL SOLAR WATER HEATERS FOR THEIR CLIENTS, SAYS ONE SOLAR VENDOR.

in the sun. These systems start at about \$2,500 and can run in excess of \$4,000. "It's more of an investment than a gas heater," concedes Leslie Cohen of Solar Industries Solar Pool Heating Systems, a Lakewood, N.J.-based manufacturer that's sold 30,000 such systems since 1976. "But with a gas heater, you're always putting money into it. Our product requires almost no servicing."

Solar Power: A Long Time Coming

The solar-electric industry owes much of its growth to the successor to airplane travel — space flight. In 1954, scientists at Bell Laboratories experimenting with photovoltaics produced solar cells that generated power at the astronomical cost of \$600 per watt. With the research impetus provided by the American space program of the late 1950s, the price per watt fell by more than 80 percent — to around \$100 per watt — by 1970. (Twenty years later, it's down to about \$5 per watt when purchased in bulk; most experts believe it will have to drop to about \$2 before it is widely used by utilities to

meet peak-load demand.)

Paul Maycock headed the photovoltaics program at the U.S. Department of Energy during the late 1970s, when the Carter administration instituted a crash program to develop alternative forms of energy. Federally funded research on photovoltaics, which stood at a mere \$5 million in 1975, had jumped to \$150 million annually by 1980. Spurred by the Arab oil embargo of 1973, at least eight multinational oil companies invested in solar-energy firms. Solar collectors appeared on roofs around the country, including the White House.

But perhaps the most significant development was the 1978 passage of the Public Utilities Regulatory Policies Act (PURPA), which forced utilities to purchase, at a premium rate, the excess electricity generated by alternative-energy sources.

In California, where air quality is a particular concern, the Public Utilities Commission responded to PURPA by guaranteeing fixed payments to producers of alternative energy. This, in turn, helped spur the growth of companies such as LUZ International. Using its "solar thermal" technology,



LUZ expects to provide the giant Southern California Edison utility with about three percent of its electricity by 1994 — meeting the energy needs of about one million people.

"PURPA means you can be your own power generator," says Mr. Maycock. "PV is uniquely distributable. So why build central power stations?" Such visions were interrupted in 1981 by what might be termed the political version of an

IOWA offers a five-year exemption on property taxes for solar-energy systems.

MASSACHUSETTS provides an income-tax credit of 15 percent for the net expenditure on a solar-electric or hot-water system (or wind-energy system), with a maximum credit of \$1,000.

MICHIGAN gives an income-tax credit for a number of alternative-energy systems, including photovoltaic and active and passive solar. The credit

is determined by the state Department of Commerce; you must submit an application to qualify.

MONTANA makes available residential and corporate tax deductions for alternative-energy systems.

NEW JERSEY provides a sales-tax exemption for the purchase of solar-energy devices.

NORTH DAKOTA offers an income-tax credit and property-tax exemption for alternative-

energy devices. The tax credit is five percent a year for three years; the property-tax exemption is good for five years after the date of installation.

OREGON has an income-tax credit of \$1,500 for alternative-energy devices; or the owner can claim a credit based on the first year's energy yield.

RHODE ISLAND allows a personal income-tax credit of 10 percent of the cost of a renewable-energy system,

not to exceed \$1,000.

SOUTH DAKOTA gives a three-year break on tax assessments to residents who install a renewable-energy resource system.

TEXAS provides a property-tax exemption for the increase in the value of a home attributable to installation of a solar-energy device.

WISCONSIN makes available property-tax exemptions for some solar systems.



LUZ INTERNATIONAL, LTD

LUZ plant, Mojave Desert, produces 90% of the world's solar electricity.

Sustained growth of photovoltaics and solar hot-water systems rests with the nation's utilities. Makers and distributors of solar hot-water systems are demanding that electrical utilities receive a larger rate of return for investing in clean energy sources. "The real revolution will occur when the utilities are given incentives to install solar water heaters for [their] clients," says solar hot-water distributor Peter Lowenthal.

Meanwhile, photovoltaics may receive a boost from the newly revised Clean Air Act, which rewards utilities that install solar and other non-polluting, renewable energy systems. California, Massachusetts, and New York have been in the forefront of considering "externalities" in determining utility rates, a move that advocates feel will make solar more competitive because it considers the environmental cost of fossil fuels.

The solar industry credits George Bush for taking a more balanced view of energy policy than his predecessor. While there are complaints that the administration favors the oil and nuclear industries, President Bush and his lieutenants win praise for a 30-percent increase in the photovoltaics research budget during the coming year.

"In the past year, the emphasis in the Department of Energy has been on developing small, cost-effective applications," says Mr. Fagnan, chief of Philadelphia Electric's Research Management Section. "Attention is being shifted from making an even better solar cell to making one that people can use."

He adds: "We're in a situation [like] black-and-white TV. Nobody wants black-and-white; everybody wants color. But you have to produce black-and-white first. You're not going to have the big markets until you have the small ones."

Louis Peck, a Washington, D.C.-based writer, formerly covered environmental issues for Gannett Newspapers. He has written several stories on solar energy.

eclipse of the sun: namely, the Reagan administration. Funding for federal research on photovoltaics plummeted from more than \$150 million to less than \$35 million by the time Ronald Reagan left office eight years later. The Reagan administration contained many free-marketers who saw no place for a government role in trying to bring solar to the marketplace. Also, many of the oil companies that invested in solar in the 1970s pulled out in the 1980s as oil dipped into the \$15- to \$20-per-barrel range.

Solar-electric manufacturers do see some silver lining in assessing the Reagan years. "This industry has been plugging along for ten years without a crisis to sustain it," says Chris Pope of Solarex, one of the largest manufacturers of photovoltaics in the country. "Thanks to federal energy policy over the last 10 years, we've learned to do without government support."

Here Comes the Sun?

Increasingly, the commercial and industrial sector is beginning to recognize the cost effectiveness of solar. "In the next five years, there is going to be an explosion of photovoltaics

in the transportation industry, as well as commercial and industrial applications," says Ron Kenedi, vice president of Photocomm, a major distributor of solar photovoltaics.

In San Diego, solar-electric cells are now used to power callboxes on the San Diego Freeway as well as to provide irrigation at the City's famous zoo. Running south of Las Vegas along I-15, the traveler will see an array of billboards powered by photovoltaics. Last year, Pacific Gas & Electric purchased 100 PV systems to power telecommunications and remote sensors, among other purposes.

Then there are automotive applications. General Motors has announced it will market an electric car within three years. Mr. Kenedi points out that smog-blanketed Los Angeles recently announced it will purchase 10,000 electric vans by 1993. Some European auto firms are already using solar electricity to power a car's ventilating fan, thereby lowering the vehicle's interior temperature as it sits in the hot summer sun. Such devices lower the air-conditioning demand on a car's engine. Ultimately, they could allow for reducing the size of the car's engine.

RECYCLING PLASTICS

That necessity, plastic. It's so much easier to acquire than to dispose of. Landfilling it just gets it out of our sight. Composting it doesn't work, really — bugs don't eat plastic.

Burning plastic, especially PVC, not only yields toxins dangerous to humans and incinerators, but also guarantees we won't get further use out of a limited resource.

So when plastics recycling was suddenly on the front page of every paper, we all breathed a sigh of relief. Technology was going to save us again. But what *is* the technical capability? The economic reality? Did we demand plastics recycling just so we could feel good about consuming more of it?

How It Works, When It Works At All

BY HANNAH HOLMES






REAPING THE BOUNTY



n a per-capita basis, each of us added 115 pounds of plastic to the municipal waste stream in 1988. It's wrapped around our feet and our food. It houses our computers and ballpoint pens. It floats our boats and insulates our homes. With 14.4 million tons of plastic going into our landfills in 1988, there's no shortage of raw materials for recycling. But diverting plastic from landfills is more than a little challenging.

COLLECTING PLASTIC IS A MAJOR HURDLE TO RECYCLING. Nearly 500 communities now collect some plastic packaging — usually soda bottles and milk and water jugs — at curbside. While plastics may account for just five percent of the weight on a collection truck, they can take up 30 to 50 percent of the space. This means that a vehicle fills up quickly and has to make more frequent trips to the recycling center. In answer to that problem, some companies are now making truck-mounted hydraulic compactors that can crush 15 to 20 cubic yards of plastic into a one-yard holding cell — the output of about 500 to 600 homes, or a full day's work.

SORTING IS ANOTHER HEADACHE. Different plastics have different chemical makeup, and they are most valuable when they're separated. With few exceptions, recycling-center workers sort the mountain of plastics by hand. There are some clues — cloudy milk jugs are HDPE, shiny soda bottles are PET with a HDPE base cup.

 Legislation requiring a stamped-on code (left) has been passed in 27 states, but plenty of containers are currently uncoded and mysterious. The slow, expensive sorting process is bemoaned by everyone in the field. It doesn't help that a family's curbside recycling bin may contain as much as 20 to 30 percent of materials or containers that the community isn't recycling. "I guess an op-

"There are no market forces that are saying, 'Ooh, ooh, we've gotta have this plastic.'"

— *Automotive Industries* Editor John McElroy, about engineering plastics



RIC MURRAY, COURTESY RISWMC

A truck adds to Rhode Island's mountain of collected plastic.

timist would say they're enthusiastic," says Dr. Tom Nosker, a researcher at the Rutgers University Center for Plastics Recycling Research in New Jersey.

Again, technology is rising to the occasion. At Rutgers, researchers have built sortation lines that use X-rays and light. On a conveyor belt, currently held together with tape and cardboard, bottles fly past identification stations. At the first station, X-rays detect PVC bottles, which are puffed off the line with a burst of air. The equipment to build such a line should soon cost less than \$25,000, says Dr. Nosker.

Another sortation technology is under study at Rensselaer Polytechnic Institute in Troy, N.Y. There, Professor E. Bruce Nauman is working on a chemical method of sortation that starts with a vat of mixed plastic flakes and solvent. At a specific temperature, the solvent will melt a specific kind of plastic, which can then be drained from the vat.

Between the collection problems and the sortation problems, we don't stand to get rich recycling plastic. But Rhode Island, with a centralized and efficient program, is trying. From 70 percent of the state's population, a fleet of state-owned trucks collects mixed recyclables, including milk jugs

and soda bottles. The goods are dropped at a materials-recovery facility (MRF) in the center of the state, where a private contractor sorts and markets them.

The state collects 70 tons of milk jugs and 90 tons of soda bottles, which are sold for eight to ten cents a pound. Edward Connelly, who manages the state's recycling program, estimated that in 1990 plastics would bring in \$250,000 to \$300,000. That would almost pay the \$35-a-ton sorting and processing bill at the MRF. (The \$90 a ton it costs to collect curbside commodities is probably not recoverable.) When it does break even on processing costs, the state will have achieved a disposal cost of zero for this portion of its waste — no small feat in the age of \$50- and \$100-per-ton disposal fees.

Consumers are instrumental in minimizing the cost of collection and sortation. Recyclers should learn the plastics code, and give only the types they're asked for. Containers should always be washed and squashed for collection efficiency. Generally, caps and pump tops should be thrown in regular trash, while labels can be left on the container.

ODD THINGS ARE AN EVEN BIGGER COLLECTION NIGHTMARE. Packaging accounted for 28 percent of our plastics use in 1988. The other millions of tons were used for such things as car fenders, computer housings, telephones, dolls, agricultural films, furniture, and stick-on fingernails.

The Council for Solid Waste Solutions (CSWS), a plastics-industry group, is just starting to address the problem of reclaiming the high-performance, or "engineering," plastics used in durable goods like cars and appliances, which claim 10 billion pounds of plastics each year. Because the additives can include such hazardous substances as cadmium and lead, each type must be handled separately. The Council will consider establishing a coding system, akin to that used on plastic packages, to help handlers separate the resins.

Engineering resins aren't used in disposable applications, but they do eventually hit the waste stream. When the average junk car goes through a giant shredding machine, for instance, the metals are recycled, but about 850 pounds of fluff — rubber, upholstery, and 60 varieties of plastic — are left to be landfilled. Even if it were feasible to strip a junker of plastics prior to shredding, John McElroy, editor-in-chief of *Automotive Industries* magazine, says, "There are no market forces that are saying, 'Ooh, ooh, we've gotta have this plastic.'" However, in Germany, car makers are already making changes that facilitate plastics recycling, in anticipation of government regulations.

As you walk down the alley toward Amoco Foam Products' polystyrene recycling plant in Brooklyn, white school-lunch trays and faded McDonald's clamshells drift forward to meet you. The floor of the cavernous building is dotted with loose trays. And flies. The smell of ripe garbage is heavy. Five Spanish-speaking women at the sorting table empty a giant bag of

McDonald's waste and pick through it. Wearing gloves and plastic goggles spattered with food, they pick out plastic bags, ketchup packets, and paper napkins. They toss the plastic clamshells, cups, and PS flatware onto a conveyor belt. In the roaring, metal belly of machinery, the plastic is ground into flakes, washed, and partially dried. At the end of the line, damp, dime-sized bits of PS fly out of a nozzle into a gaylord (a standard-size cardboard box). In between, the washer emits brownish-gray water and scum.

THE COST OF THE TECHNOLOGY IS RELATIVELY LOW. The National Polystyrene Recycling Company plans to lease and equip four regional facilities, each capable of handling 13 million pounds a year, at a cost of \$2 to \$3 million each. The Johnson Controls facility, capable of recycling 24 million pounds of PET a year, was an investment of \$3.3 million. The Sonoco Graham bottle recycling plant cost \$5 million to design, build, and equip.

In fact, the research at Rutgers is making the cost of getting into plastics recycling downright cheap. For a \$3,000 licensing fee, interested parties can get access to Rutgers' PET technology. In an hour, the system can produce 500 pounds each of clean, dry PET flake and HDPE flake, plus a bit of scrap aluminum. The equipment costs about \$1 million.

NEW POLLUTION IS GENERATED FROM THE REMELTING OF PLASTIC, but it's minor in comparison to the toxins cranked out by refineries whence

virgin plastic feedstocks come. In the federal Environmental Protection Agency's most recent assessment of the release of toxics into the environment, Texas and Louisiana — the refinery states — came out on top, by hundreds of millions of pounds. Each of three petrochemical facilities, owned by American Cyanamid, Shell Oil, and Du Pont, out-toxed 29 states' totals.

That's not to say recycling plastic creates no pollution. Complying with federal requirements, one major PET recycler, Wellman, Inc., reported releasing into the environment or transporting off-site the following toxins in 1988: 383,128 pounds of terephthalic acid, 143,098 pounds of ethylene glycol, and 1,500 pounds of 1,1,1-Trichloroethane, in addition to unspecified amounts of sodium hydroxide, antimony, phosphoric acid, and sulfuric acid. PlasticsAgain, which in melting foamed PS releases the gases trapped in it, has a state air-emissions permit to release a small amount of carcinogenic styrene, as well as up to nine pounds per hour of each of five ozone-eating and smog-making compounds: butane, isobutane, Freon 22, pentane, and isopentane.

In addition, the water used to wash plastics has to be considered; although some facilities filter and reuse their washwater, others, like PlasticsAgain, use it once and send it down the drain.

In a report issued in 1989, Franklin Associates, Ltd., analyzed the energy and environmental impact of various soft-drink containers. Paid for by the PET industry, this study appears far from impartial. Even so, it concluded that at current recycling rates, the 16-oz. refillable glass bottle creamed the competition. The 16-oz. PET bottle created 92.3 pounds of air pollutants (not named) to deliver 1,000 gallons of pop, compared to glass's 53.8 pounds. PET required 15.9 pounds of water pollutants (also unnamed) to glass's 8.2 pounds. Furthermore, the study concluded that the 16-oz. PET bottle and the 12-oz. aluminum can use twice as much energy to deliver 1,000 gallons of product as does a refillable, 16-oz. glass bottle.

Finally, the pollution from recycling plastic is usually generated in a "cascading" process, where a highly recyclable item like a container is made into a hard-to-recycle item like plastic lumber or carpet fiber. To make a plastic food container back into a food container, as is done with glass and aluminum, will probably require intensive chemical and/or heat cleaning with a greater environmental impact.

While the Franklin Associates study credits PET-recycling with reducing the amount of virgin PET used overall, it offers no proof that the new, cheap supply of PET, subsidized by various collection systems, doesn't create *new* uses for the resin, rather than reducing overall demand.

GETTING RID OF THE BOUNTY

In recycling, there are easy-going plastics and very uptight plastics. PET is slack. Films and PVC are problematic. The difference is in collection and sortation, as well as in the inherent peculiarities of some plastics.

PET (POLYETHYLENE TEREPHTHALATE): It has the advantage, thanks to deposit-and-return bottle bills, of markets that have been building for 10 years. Day and night, tractor-trailer trucks pull into Wellman, Inc.'s Johnsonville, S.C., plant. Wellman has been quietly recycling post-consumer plastic since Michigan's bottle bill began generating used PET in 1979.

From the bottles, Wellman makes a polyester fiber which it sells to manufacturers of carpet, sleeping bags, pillows, and ski jackets. Although there's no way to detect it, some 35 percent of

THE PLAYERS

NICKNAMES AND COMMON USES

PET: polyethylene terephthalate, (vegetable-oil and soda bottles)

HDPE: high-density polyethylene, (milk and detergent jugs, dull grocery bags)

PVC: polyvinyl chloride, (vegetable-oil bottles, food wrap)

LDPE: low-density polyethylene, (glossy grocery bags, bread bags)

PP: polypropylene, (jar lids, some tubs and syrup bottles)

PS: polystyrene, (foamed fast-food ware, clear flatware and salad-boxes)

CURRENT USES OF OLD PLASTIC

PET: fiber, carpet, paint containers, strapping, auto parts, tennis balls, shower curtains, paint brushes, scouring pads.

HDPE: detergent and engine-oil bottles, bathroom stalls, plastic lumber, recycling bins, soft-drink base cups, combs.

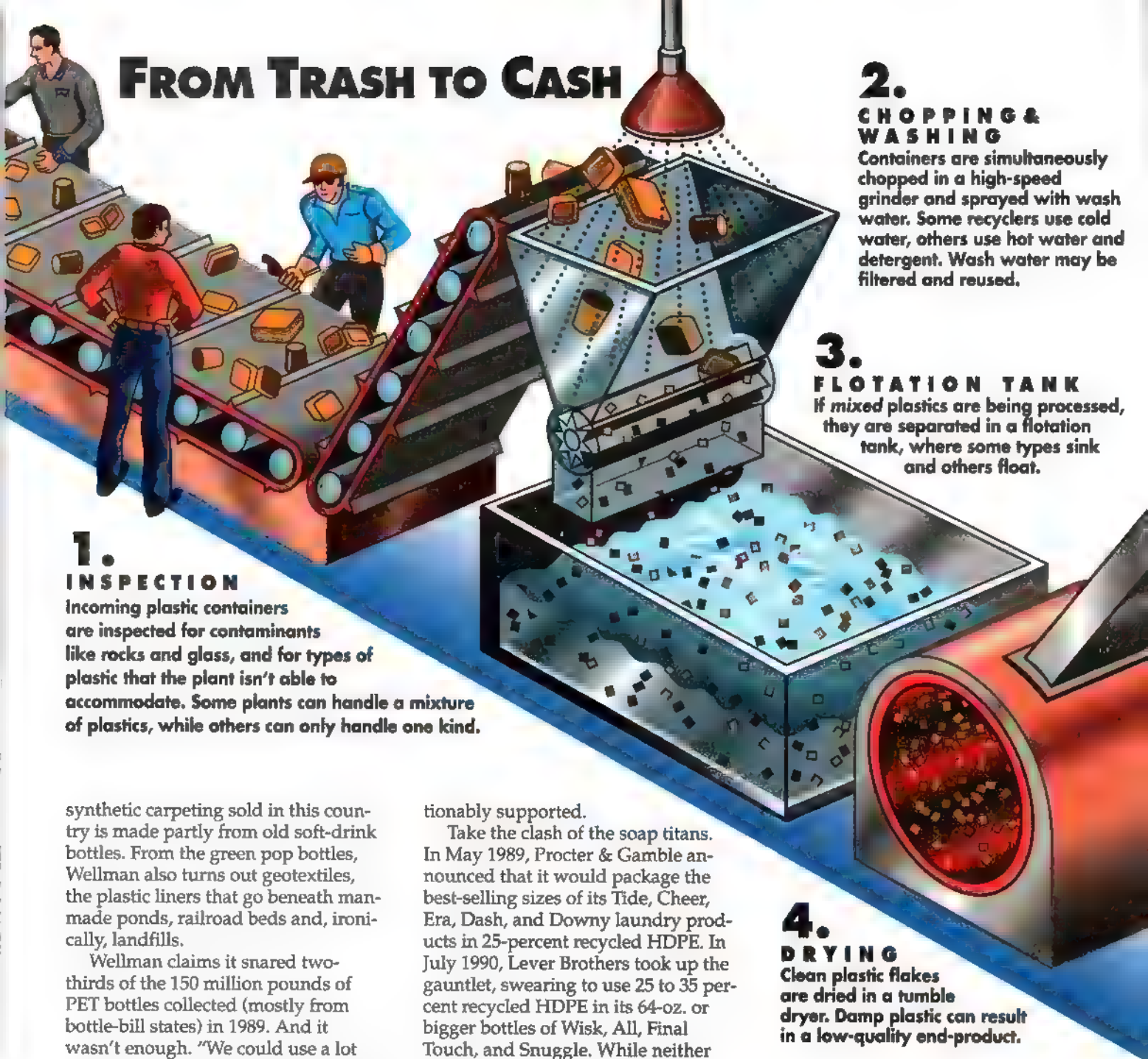
PVC: tile, drainage pipe.

LDPE: garbage bags, recycling bins.

PP: grocery-basket handles, auto batteries.

PS: desk accessories, trays, insulation, packing "peanuts," waste baskets, VCR cassettes.

FROM TRASH TO CASH



1. INSPECTION

Incoming plastic containers are inspected for contaminants like rocks and glass, and for types of plastic that the plant isn't able to accommodate. Some plants can handle a mixture of plastics, while others can only handle one kind.

synthetic carpeting sold in this country is made partly from old soft-drink bottles. From the green pop bottles, Wellman also turns out geotextiles, the plastic liners that go beneath man-made ponds, railroad beds and, ironically, landfills.

Wellman claims it snared two-thirds of the 150 million pounds of PET bottles collected (mostly from bottle-bill states) in 1989. And it wasn't enough. "We could use a lot more than we're able to acquire," says Caroline Mixon, Wellman's recycling manager. "The growth of curbside collection is very slow."

In a decade, recyclers have learned to make old PET into everything from Spic and Span Pine Cleaner bottles to hairbrushes and scouring pads.

HDPE (HIGH-DENSITY POLYETHYLENE): Recycling of this common plastic is growing fast, primarily because milk jugs and detergent bottles are easy for curbside recyclers to recognize. These and other HDPE containers and bags account for about 30 percent of our packaging. The demand for HDPE is steady, but ques-

tionably supported.

Take the clash of the soap titans. In May 1989, Procter & Gamble announced that it would package the best-selling sizes of its Tide, Cheer, Era, Dash, and Downy laundry products in 25-percent recycled HDPE. In July 1990, Lever Brothers took up the gauntlet, swearing to use 25 to 35 percent recycled HDPE in its 64-oz. or bigger bottles of Wisk, All, Final Touch, and Snuggle. While neither company can guess how much post-consumer HDPE will be available, P&G's commitment amounts to 15 to 25 million pounds in 1991, and Lever Brothers' is 10 to 20 million pounds. It would seem that there's a healthy recycling economy here.

But remember that the soap companies made loud, public promises to use recycled plastic — embarrassing vows to break, no matter how high the price might go. Lever, for instance, has committed to using half the 20 million-pound annual output of Sonoco Graham's new bottle plant, though the cost of the recycled bottles may surpass virgin ones. "Our

2. CHOPPING & WASHING

Containers are simultaneously chopped in a high-speed grinder and sprayed with wash water. Some recyclers use cold water, others use hot water and detergent. Wash water may be filtered and reused.

3. FLOTATION TANK

If mixed plastics are being processed, they are separated in a flotation tank, where some types sink and others float.

4. DRYING

Clean plastic flakes are dried in a tumble dryer. Damp plastic can result in a low-quality end-product.

customers are not in it for the money," says Roger Prevot, a vice president at Sonoco Graham.

PS (POLYSTYRENE): The National Polystyrene Recycling Company has set out to prove that the fluffy stuff we so revile has a recycling future. NPRC, funded by seven plastics companies, is siting five cleaning and pelletizing plants around the country. The first, PlasticsAgain, has been operating in Leominster, Mass., since mid 1989; the second opened in Corona, Calif., in October 1990. By 1995, NPRC aims to

collect and pelletize 25 percent of the 1 billion pounds of PS packaging we use each year.

Although PlasticsAgain predicted profitability for December 1990, in November the plant was selling pellets at a loss. Current customers include Rubbermaid and Pimby Co., which use recycled PS in office supplies like pens, rulers and trays. Other customers include Dow and Amoco — each of which has invested \$2 million in NPRC.

PP (POLYPROPYLENE): This resin accounts for only 10 percent of our plastic packaging waste. It's used for the occasional syrup bottle or margarine tub, but is commonly found in bottle caps, straws, labels, and liners. This makes it hard to collect in marketable quantities. A few PP manufacturers have offered to take back collected PP, but they aren't paying anything for it, says CSWS spokeswoman Susan Vadney.

PVC (POLYVINYL CHLORIDE): Occidental Chemical Corp. (OxyChem), a major PVC maker, has started a buy-back program. In late 1989, OxyChem announced it would pay eight or nine cents per pound for PVC bottles in large lots. It's a good price, but not good enough. Dr. William F. Carroll, Director of Commercial Development, says that the company bought only 300,000 pounds in the first year. With a high purchase cost, low volume, and as yet no salable product, Dr. Carroll chuckles, "I doubt it will add two

dollars to our stock price."

Because of its low melting point and its chemical composition, PVC is the pariah of plastics recycling. For example, in order to make mixed plastics malleable enough to mold into plastic lumber, all the plastics must be heated to the temperature where the most heat-resistant one softens. If PVC is overheated, it will begin to gasify. Not only does that degrade the PVC, but it also releases toxic, corrosive hydrochloric acid into machinery and the air.

FILM: According to a Rhode Island survey, half of a household's plastic-packaging waste is film. Plastic film is rarely recycled, because it's hard to clean and hard to sort. Virgin LDPE, HDPE, and PVC can all be made into films and sheeting that look fairly similar to each other.

Under heavy attack from the paper-sack industry (not to mention the canvas-bag industry), Sonoco Products and Mobil, both of whom make LDPE and HDPE grocery bags, have each promoted supermarket bag-collection programs. Sonoco's bags are mixed with paper to form a protective shipping material, a 'recycling' program that costs Sonoco "multiple hundreds of thousands of dollars," according to a spokesman. Mobil makes its old sacks into industrial garbage bags.

MIXED PLASTICS: With manufacturers of everything from diapers to plastic-laminated juice boxes triumphantly announcing that their

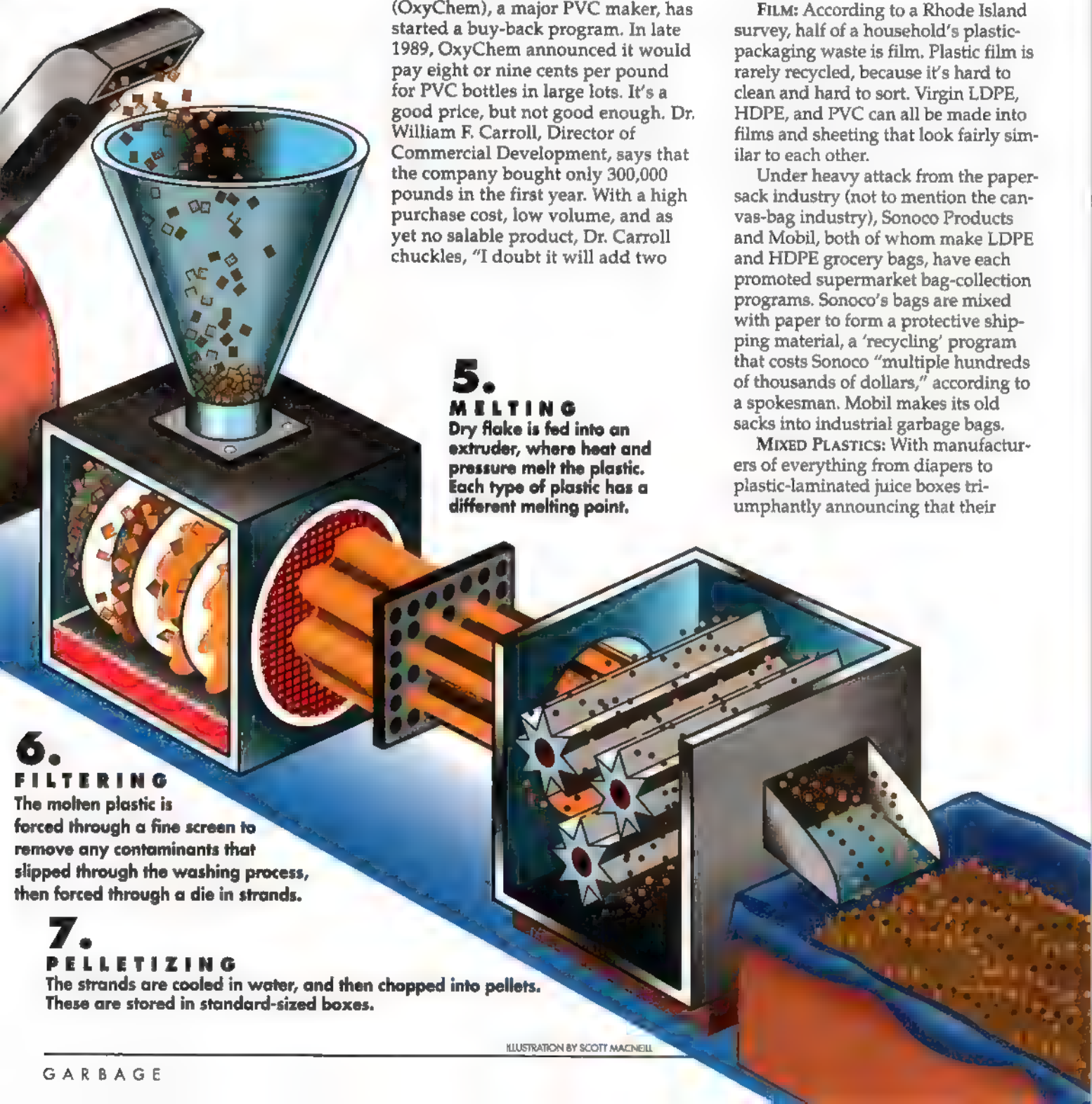


ILLUSTRATION BY SCOTT MACNEILL

"Our customers are not in it for the money."

— Roger Prevot, of Sonoco Graham Co., which makes recycled bottles

product could be recycled into plastic lumber, the notion got around that plastic-lumber machines were going to sweep the dumpster clean of low-demand plastics. The demand for mixed plastics, in reality, is mixed. Floyd Hammer, who founded Hammer's Plastic Recycling in 1987, steers clear of both PS foam and PVC. With a rigorously followed recipe, he uses milk jugs, some film bags, PP trim from diaper factories, and some non-foamed PS in his park-bench lumber. Products that don't take as much abuse as a bench, such as landscaping timbers, can tolerate a higher level of low-demand resins, Mr. Hammer says, but the ban on PVC and foamed PS stands. So much for salvation. While other companies may indeed

use those materials, Hammer's Plastics Recycling is notable because it is a proven success. The company grossed \$4.2 million last year, and will use 8 to 10 million pounds of mixed plastics next year.

Nationwide, some 570 companies now buy collected bottles and containers, and about 150 companies turn old plastic into pellets or new products. While soda bottles and milk jugs are the plastics of choice, someone, somewhere, is probably recycling what you're trying to get rid of, be it a shower curtain or a mashed Mr. Potato Head.

On the other hand, no matter how strong the demand is for a resin, your tax-supported sanitation department performs the clumsy, expensive tasks

of collection and, in some cases, sortation. This is no different from the situation with newspaper, glass, and aluminum — but when the number crunchers announce that recycling plastic is a profitable enterprise, remember that your tax bill is part of the equation.

LIMITED AFTERLIFE OPTIONS

Park benches and flower pots, flower pots and park benches. These things are relatively easy to make. Some plastic lumber machines will pack anything — all sorts of plastic, paper, bits of metal — into a mold, no cleaning required. But closing the loop — making milk jugs back into milk jugs and car-

PARK BENCHES AND P.R.

In the late '80s, banning plastic became a sort of fad. School children, heavily armed with cuteness, have driven polystyrene from lunchrooms and towns alike. Cities like Newark and Minneapolis have laid down laws that make recycling a condition for using certain plastics. In 1990, 508 plastic-related bills were introduced by state and local governments, according to Council for Solid Waste Solutions, an organization created by the Society of the Plastics Industry to counter this anti-plastic zeal.

The plastics industry has responded with PR stunts and park benches, the stars of the "feel good about plastic" brochures. This has led to widespread speculation among prestigious physicists as to how many plastic park benches the Earth's crust can support. Eight million tons of plastic packaging per year translates into 128 million four-foot park benches. Each year.

Mobil and Sonoco's plastic-bag-collection programs aim to show that plastic grocery bags are recyclable, and therefore good for the environment. These programs are supposed to make consumers feel good about using disposable products instead of investing \$5 in a canvas bag. Sonoco's promotional material featured a drawing of ... you guessed it, a park bench.

Procter & Gamble, trying to sweeten our souring image of plastic-wrapped disposable diapers, has been banging the PR drum

about a seven-month pilot project in which soiled diapers are being collected from Seattle homes for recycling. The diapers are separated into various commodities, the plastic going into ... yup, flower pots and park benches. Perhaps this experiment will eventually yield an economical and ecological solution, but the sound and fury over a 800-household, \$750,000 pilot project is just noise.

BFGoodrich, the largest U.S. vinyl manufacturer, wasn't willing to offer a bottle bounty as the competing vinyl-maker, OxyChem, did, so it settled for a press stunt. BFGoodrich's recent mailing contained an anemic press release saying that the company had donated to the Akron, Ohio, zoo a "conservation garden" featuring recycled-vinyl walkway tiles and, surprise, surprise ... plastic park benches (and fencing). Later, a BFGoodrich spokesman admitted the company bought most of the recycled items from other manufacturers.

Then there's good, old-fashioned hypocrisy. Lever Brothers' trumpeting about recycled Wisk bottles suddenly sounds tinny as the company rolls out

Power Scoop, a small box of concentrated detergent. It not only boasts a whopping 12 percent phosphate content, but packs a disposable plastic scoop.

"It's coded for recycling!" squeaks a Lever spokeswoman. So we'll be watching for a park bench made from detergent scoops.



peting back into carpeting—is harder. Until we do it, we'll require virgin plastic for each new milk jug, and the old milk jugs will accrue in piles of plastic lumber and flower pots. And closing the loop for food packages will require some trail blazing.

"I wouldn't say this is the gold rush," says Kenneth Falci, a consumer-safety officer and recycling expert with the FDA. He tells of a recycler who washed and repelletized a batch of HDPE milk jugs. A few weeks later, the pellets began to reek of sour milk. The plastic had actually absorbed the milk and bacteria. This type of difficulty has FDA and the plastics industry bickering over whether a food packager should seek FDA approval before using recycled plastic.

FDA's skepticism notwithstanding, the industry is pressing forward. Dolco Packaging Corp., the largest PS egg-carton maker in the country, has convinced the FDA that its secret process produces post-consumer PS that's clean enough for dry food like eggs. Another egg-carton maker has been using recycled PET *without* the FDA's blessing, but, for financial reasons, production was to cease by 1991.

Things are hopping on the soda-pop front. Pepsi and Coke have been meeting with FDA since mid 1990, each seeking approval for a method of purifying PET for food use. Each company recently claimed it would be the first to use a partly recycled bottle, sometime in '91. Johnson Controls, the country's largest maker of PET soda bottles, is plucky, if tight-lipped, about a plan to close the loop. Says spokesman Floyd D. Flexon, "Guaranteeing quality for food contact is something we are confident we can do."

PLASTIC ITSELF LIMITS REUSES. Even if regulatory hurdles didn't exist, there are thorny technological obstacles ahead for recyclers. Three of these are "heat histories," colors, and contamination.

A resin's heat history is like its medical record, except that the information isn't written down anywhere. A virgin polymer begins life as a long chain of identical molecules, or "monomers." The length of the chain is directly related to plastic's strength. Each time the polymer is heated, the chain breaks into shorter pieces.

Removing the color from a plastic container is like trying to take the sugar out of a baked cake—it doesn't



PHOTO: COURTESY OF SONOCO GRAHAM

Pellets of recycled plastic will be used to make new products.

just wash off. Collected containers could be separated by color, but sortation is primitive and expensive. Because a recycled resin made from mixed colors often comes out gray-green, the surest way to ensure consistency is to add black colorant. Recycled flower pots are black. Recycled rulers are black. Recycled pens, keychains, garbage cans, and floor tiles are black.

"Natural" resins like uncolored PET, and milk and water bottles, can be colored just as though they were virgin resins. But supplies are short. So at Sonoco Graham's recycled-bottle plant, bottles are made from three layers of plastic. The inner and outer layers are virgin; the middle layer is recycled—and black.

This sandwich also addresses the third hurdle, contamination. Plastic containers collected at curbside may have held kerosene or old nails, and may have been collected along with broken glass. A bit of grit that gets through the system can result in a leaky bottle. Sonoco Graham's virgin inner layer provides a guaranteed-clean, strong barrier.

The Sonoco Graham bottle can be recycled again, but each new bottle also requires virgin resin. Until technology permits this kind of loop to be closed, the "cascading" recycling of plastic will mainly defer the inevitable day when plastic goes to the dump. Technically, an old plastic park bench can be chewed up and melted down. Practically speaking,

it's hard to envision a strong market for a mystery-mash of aged and sagging plastic lumber.

THE DUBIOUS SOLUTION

As long as we need packaging, there's reason to suspect plastic isn't the *worst* option. In our paroxysms of guilt, we may have attacked the wrong thing. Referring to a Newark, N.J., ban on plastic fast-food packaging, Rutgers' Tom Nosker shakes his head.

"There are a lot of politicians out there who'll go down in history as having overreacted," he says. "Go to Newark, and see what restaurants are using for food packaging. They're using polyethylene-coated paper. It's not degradable or recyclable."

Anyway, it looks like we got what we wanted. While the rate of plastic recycling is currently puny, new curbside programs are coming on line almost daily. Newspapers are plastered with recycled-plastic stories. And many of the big names in plastic are facing the music, creating alliances and factories that appear built to last.

Du Pont, the nation's biggest producer of plastics, has tied the knot with Waste Management, Inc., the country's biggest hauler of garbage. The result, Plastic Recycling Alliance, has built two and plans three more \$5 million plants, each capable of processing 20,000 tons of mixed bottles a year. Browning Ferris Industries, another big garbage-hauler, has joined Wellman, Inc., the PET recycler. BFI will sell Wellman the bottles it collects from 920,000 households, adding bottle types as Wellman adds technology. Union Carbide has promised to open a 20,000-ton recycling center, to be located in Piscataway, N.J., that will accept unpopular plastics like motor-oil bottles and films.

There are clear environmental benefits to lightening the garbage truck's load, and to reusing resources. And plastic is an excellent material to concentrate on—life without computers and contact lenses, artificial limbs and light-weight, fuel-efficient cars wouldn't be the same. But to mutter, "It's OK, I can recycle it," as we load our shopping carts with unnecessary plastic, is to ignore the ecological and financial cost of the original resource, and of its recycling.

Solstice

The Catalog of Solar Gizmos



Solar power.

The image of a flannel-clad couple tending panels on the peak of log cabin comes to mind. But wait. Solar *safari hats*?

Solar *mosquito guards*?

They're for sale in such

diverse catalogs as the

posh Hammacher

Schlemmer Christmas

edition, and the gritty

Real Goods. What has

solar power come to?

Actually, it's been

coming for a while. Solar

watches and calculators

appeared in the early

'80s, followed a few

years later by the goofy

solar hats and toys. And

these days, *some* solar

items are downright

pragmatic. Practical

items like a lantern or

radio let you pull out of

the CO₂-producing power

grid, and reduce the 17.7

pounds of batteries the

average American junks

annually. Judging from

the array of solar-pow-

ered gimcracks and gad-

gets out there now, solar

is ready to come down

from the roof.

SOURCES: BROOKSTONE COMPANY, 1055 FARM RD., PETERBOROUGH, NH 03458, (603) 924-7181; (CAR FANS) HAMMACHER SCHLEMMER, DEPT. 99108, P.O. BOX 2549, NORTHBROOK, IL 60062-0549; (800) 345-8400; ASK FOR DEPT. 608; (HATS) JADE MOUNTAIN, P.O. BOX 2616, BOULDER, CO 80506-4616; (800) 442-1972; (MANY TOYS AND TOOLS) PHOTOCOM, INC., 7681 E. GRAY RD., SCOTTSDALE, AZ 85260; (800) 223-9380; (TOOLS FEW TOYS) IBM INTERNATIONAL, 16022 AMNITA ST., SUITE 12, VAN NUYS, CA 91406; (818) 786-2016; (MUSICAL ITEMS, BATTERY CHARGERS) REAL GOODS TRADING CO., 166 MAZZONI ST., URBAN, CA 95482; (800) 762-7323; (MANY TOYS AND TOOLS),

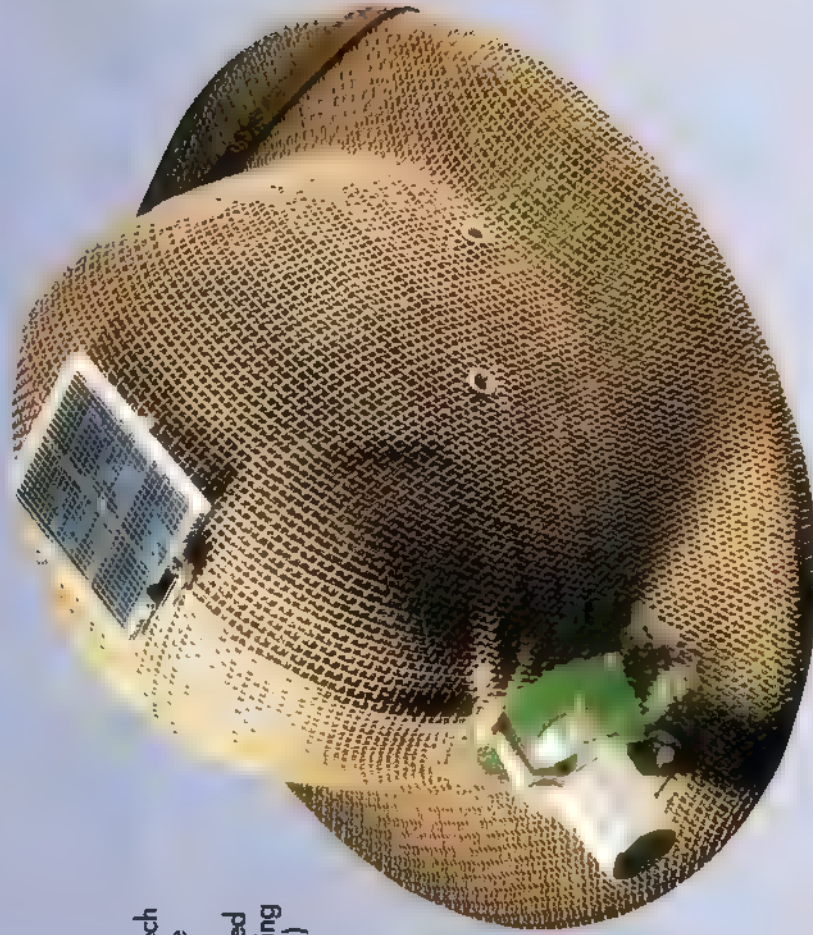
Sun-Tea Time

Appropriate technology in the no-tech area of sun-tea brewing. Add to the simple scenario of water and tea leaves a bright yellow, solar-powered stirring paddle. Also good for keeping your goldfish moving. (Just kidding.)



Stylish Sunshade

A little solar panel on your noggin powers a fan that blows air on your face. Dampen the spongy band for maximum effect. If you wear this on safari, at least the endangered species will die laughing.



Car Cooler

The smell of broiling vinyl upholstery on a summer's day is enough to make the least chemical-sensitive among us gag. So put the vent fan in your window, and harness those murderous beams to cool your car instead.



Night Sunlight

Even when they're unused, flashlight batteries fade — who hasn't encountered that pathetic glow in an emergency? The solar lantern spends its days recharging, not petering out. No more candle-lit walks in the cellar when the fuses blow.



Sunny Sounds

Whether it's sitting on a sunny windowsill or a sand dune, this Walkman-sized AM/FM radio comes in loud and clear. Built-in battery can be charged with solar energy or with the hand crank.



Tuneful Visor

There's nothing so cool as bopping on the boardwalk, wearing this slick sunshade. The top of the visor collects energy, which is translated into tunes that tinkle from the AM/FM radio into your ear.

Solar 'Skeeter-Beater

This little solar panel, the size of a match box, emits a high-pitched whine that allegedly annoys mosquitoes. Will it force your dog to run away from home?





"The myth oaks and
elm-trees stand out
Self-poised upon their
prodigy of shade

Aurora Leigh by E. B. Browning

BURYING THE MYTHS OF TREE PLANTING

Trees, embodying as they do all of nature's cycles — germination, growth, vigorous life, death, and decay — have long inspired poets and artists. In literature, planting a tree often becomes a symbol of renewal, and an act of faith in the future. Oddly enough, one of the most inaccurate literary works about tree planting is perhaps the most popular.

In *The Man Who Planted Trees*, Jean Giono weaves a simple tale about a shepherd named Elzeard Bouffier, who lived in a barren, desiccated district in the southern French Alps. Each day, Elzeard planted 100 acorns on the sunny hillsides nearby. He grew birch seedlings and planted them in the val-

leys. Eighteen years later, according to the story, the author returns to find a bird-filled forest. The people of the region return to their abandoned villages, and proclaim the wonder of this "natural" forest.

Most readers don't realize that this charming story is an allegory. Such a transformation is an ecological impossibility. Even so, Earth Day 1990 was awash in ritual tree plantings, with many references to using trees to combat global warming. As a metaphor for affirmative individual action, planting a tree works. As a practical measure for cutting greenhouse gases, it's negligible. [See "Ask Garbage," July/August '90 — editors]. But there is someone who really understands the reality of tree planting.

For 30 years, Al Seubert, now 73, has been tirelessly cultivating the slopes of a windswept hillock in South San Francisco. So far, this retired pharmacist has planted more than 25,000 trees. Neither drought, gophers, wind, repeated grass fires, vandalism, nor trash has swayed him from his chosen task.

One warm, windy afternoon, I met with Al to find out how this man-of-the-trees tends his hill, and what drives his persistent planting. "I got started because the park director [of South San Francisco] got the Boy Scouts to plant 2,000 trees where he thought a park should be," Al recalls. "But the ground was too hard and the kids left many of the trees half out of the ground, so I replanted

TEXT AND PHOTOS BY ROBERT KOURIK

**IN 30 YEARS, AL
SEUBERT HAS PLANTED
25,000 TREES —
LESS THAN HALF HAVE
SURVIVED.**

them. Other local kids set the hill on fire and the trees burned up. I planted more trees, scraped away the grasses, and dug up all the soil for a radius of 20 feet around each tree to protect it from fire."

These new trees survived more arson, and grew to four feet tall, when one day he walked up the hill to find that "someone had dug 'em all up and taken them away."

Most of the first plantings were scorched two or three times by fires. The survivors form a shady grove covering nearly four acres. As Al proudly points out, "they're nearly 40 feet tall, with a trunk about a foot thick." Sadly, of the 25,000 trees he's planted, less than half are still alive.

Many well-meaning volunteers are all for planting trees, but few realize how hard it is to maintain them. Over the last four Arbor Days, local people have shown up on Al's hill to plant trees. Al scales the 600 steps he carved into the steep hillside to pre-dig all the planting holes. Yet the planting is just the start of the tree-growing process.

STAKES

Don't make the stake mistake! Trees that stand on their own are stronger.

ROOTS

Carefully spread the roots over a cone of soil. Avoid overfeeding them.

For many years, Al would load his car with 80 one-gallon jugs of water, and scamper across the hill, soaking each tree with half a gallon every month. More recently, he's dug "a couple of miles" of trenching for water pipes that bring municipal water closer to the trees. More than 600 feet of hosing snakes through grass, brush, and rocks to tend all the young seedlings. "I water for the first two years," he says, "then I tell 'em they have to do it themselves."

After reading *The Man Who Planted Trees*, Al tried sowing oaks. "I collected two and a half gallons of tan-bark oak acorns. I did like the man who planted trees, I'd count out 100 acorns and plant them each time I went up on the mountain. Eventually, I planted 1500 acorns, but a good percentage didn't make it — [now] I have maybe 200 oak seedlings. Because of our drought, they haven't grown much, that's for sure. No forest of oaks yet, and certainly no streams."

Over time, Al has found that seedlings have the best chance of surviving. He raises many of the future transplants himself in long, skinny tubes — 2,000 healthy seedlings are growing in protective shade in his

MULCH

Three to six inches of mulch will help trap moisture. Use more in dry climates.

SOIL

A six- to 12-inch mound of well-draining soil will prevent crown rot.

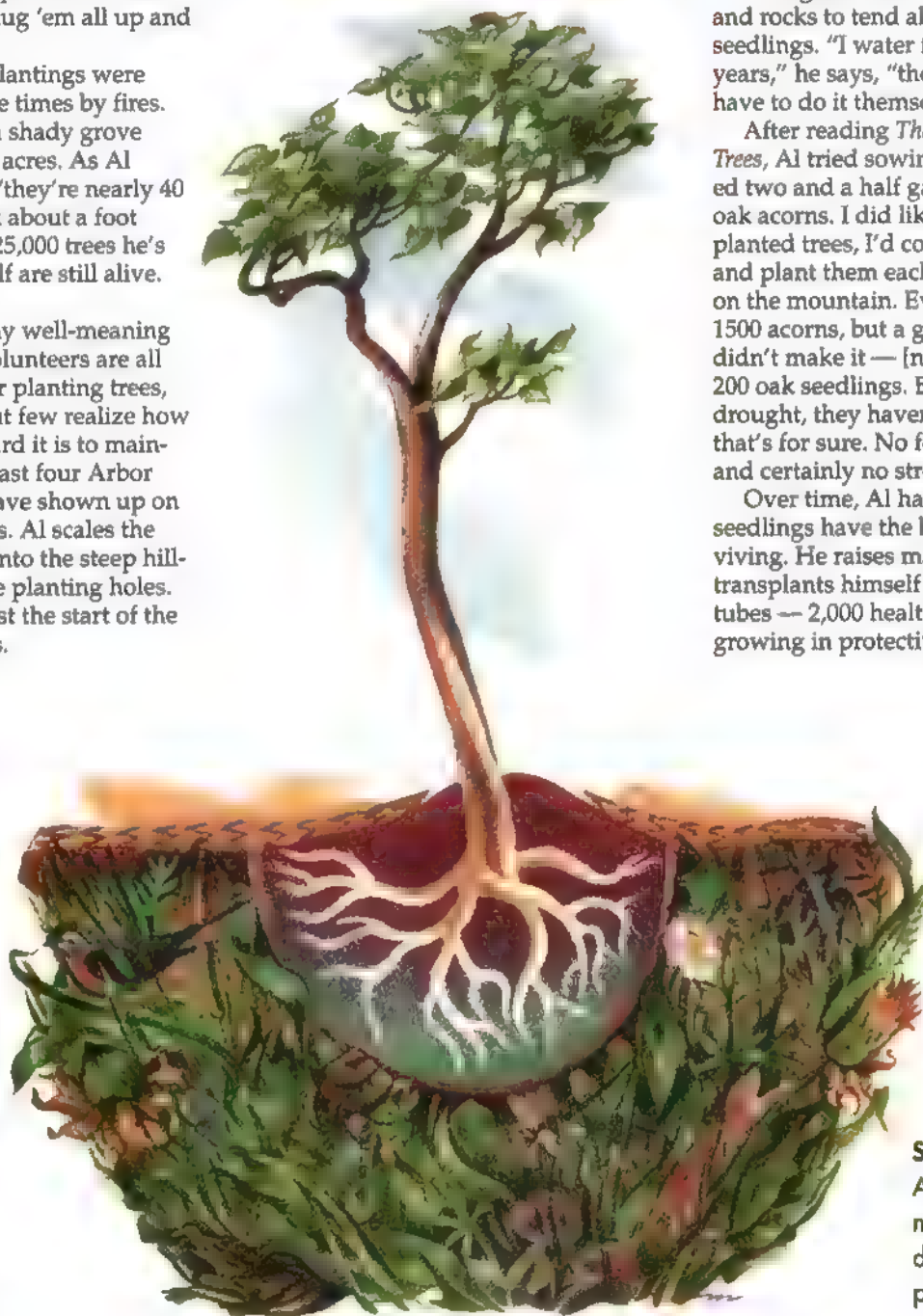


ILLUSTRATION BY MICHELE LAPORTE

backyard. He grows redwood, pine, madrone, fremontia, ceanothus, and liquid amber from seed. On the hill, some of the redwood trees — started from redwood cones collected in Marin County four years earlier — are already eight feet tall.

Al didn't start planting trees because he wanted to Save the Earth or cut greenhouse gases. After all the fires, vandalism, and replanting, he continues laboring simply because "I love to plant trees."

So many articles praising tree plantings mention only the number planted, not the number that survive. Often, the survivors are pathetic, crippled specimens vulnerable to drought, wind, and ice. Let's look at planting methods that are based on how a tree actually grows. These techniques avoid fertilizers and use the least amount of water necessary to produce a hardy tree. The following discussion pertains to planting trees in your yard, not planting for reforestation — which calls for entirely different strategies.

Choosing

Perhaps the single most important step when planting a tree is selecting the species. During the frenzy of Earth Day plantings, well-meaning volunteers planted water-grabbing, fire-prone eucalyptus trees in the arid, wildfire-disposed Los Angeles basin. These tree-planting "environmentalists" did more harm than good.

The first rule is to select trees that easily naturalize to the local environment. Don't choose some exotic species just because you grew up with it in some other region. Native trees should always be the obvious choice. Observe your neighborhood. Learn which native trees combine longevity and a good-looking form; which are resistant to both pests and disease.

I'm not opposed to planting some non-native trees. Some exotic species may out-perform native types. For example, the ornamental pistachio (*Pistacia chinensis*) is very drought-tolerant and disease-resistant. Originally from China, its brilliant, orange-red fall foliage is far more dramatic than most of California's native trees.



Pot-bound roots don't recover.

But you must be extra selective when choosing exotic trees. Bailey's acacia (*Acacia baileyana*), a nitrogen-fixing leguminous type from Australia, is one of the most drought-tolerant trees available. It sports glaucous-green foliage and blossoms into blazing, yellow flowers during California's mid-winter. However, it spreads with a vengeance, choking out native plants with its thickets of shade.

Don't forget to consider the tree's rootstock. Roots have different tolerances of soil types, which range from sticky, "gumbo" clay to quick-draining, infertile sandy soils. The madrone tree (*Arbutus menziesii*), native to the woods around my house, is very drought-tolerant, and thrives in the rocky outcroppings at the top of my ridge. But plant the tree in poorly drained or heavy clay soil, and it will die faster than you can say "Save the Earth." Conversely, California's native western alder (*Alnus rhombifolia*) thrives along creek banks, its roots undulating beneath the flowing water. But it won't tolerate sandy, well-drained soils unless it's irrigated.

Talk to your local nursery people, the folks at the County Cooperative Extension, or members of a nearby native-plant society to help you choose a regionally appropriate tree.

Transplanting

I'm convinced the best trees start from small trees, especially when transplanted from containers. Far too often, people buy large trees to make an instant impression, only to watch the tree decline and turn into upright

kindling. After planting, smaller trees which haven't outgrown their container will quickly outgrow larger, root-bound trees.

One of my clients once planted part of a slope with six-foot, root-bound trees taken from 15-gallon containers. On the windiest side, I planted the same tree-types (Monterey cypresses, *Cupressus macrocarpa*), which had grown to just 12 inches in one-gallon cans. In four years, the trees from the one-gallon containers were taller than their eight-year-old peers.

A well-anchored tree starts with an undamaged root system. No matter what the tree's size, check to make sure the roots haven't filled the container. Roots that have circled around the bottom of a container are permanently damaged. You can cut, tear, and spread these roots all you want at planting time, but you won't get a natural, healthy root system.

Some of the fastest-growing trees are transplanted from tube containers. Ranging from six to 18 inches deep, tubes are good for raising many types of tree seedlings. They especially benefit seedlings that form taproots after sprouting, such as nut trees and oaks. (With tube-grown seedlings, you get the added benefit of trees that cost less, and require less resources to grow.) Nevertheless, the seedling must be young and very small — even a tube can damage a seedling's roots. A six-month-old, blue-oak seedling just three inches tall may have a taproot measuring over 40 inches.

When you're buying bare-root stock or balled-and-burlapped trees, be sure to select a well-branched specimen with a large root system that's proportional to its canopy. The height of the trunk should be no greater than six times the width of the roots.

Digging

To understand planting, you need to understand how roots grow. Contrary to the common misconception, the roots of a tree will often be half again as wide as the canopy in heavy, clayish, soils, and three times wider than the foliage in loose, sandy soils. No matter how large your planting hole, the tree's roots will usually

**MANY WELL-MEANING
VOLUNTEERS ARE ALL
FOR PLANTING TREES,
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HARD IT IS TO
MAINTAIN THEM.**

want to grow beyond it.

Tree roots do their "grazing" near the soil's surface, not down deep. The top two feet of the soil provide over 50 percent of the water and nutrients for good growth. Deeper roots gather some nutrients and moisture during droughts, and help anchor the tree.

Tree roots are lazy. They'll feed where the eating is the best and the easiest. If you dump a pile of compost and fertilizer in a planting hole, the roots will colonize the hole and happily pig out on the convenient feast. Don't serve the tree a huge "breakfast," and then expect it to look for lunch and dinner outside the planting hole. Studies done at the University of Oklahoma show that trees with *no* additional nutrients or soil amendments in the planting hole grew better than amended plantings. Save your compost for the vegetables.

The upper 12 inches of any root system is the portion most vulnerable to crown rot, a fungal disease that can slow the growth of a tree or even kill it. Good drainage in the upper 12 inches of the soil will help prevent rot. Planting on a 6- to 12-inch mound of well-drained soil will protect roots from crown rot, and encourage superior growth. (If you have sandy soil, a raised planting area isn't necessary.)

Even in arid areas, you needn't worry about the mound drying out and killing the young tree. The natural vigor of the roots enables them to quickly grow beyond the planting hole and mound.

Work clayish soil with a spading fork to keep it from gumming up. Save your sweat and dig a hole only as shallow and narrow as is necessary to fit your transplant's root system. Remember, a 6- to 12-inch planting mound is more important than the hole, which should only be as deep as those roots that won't be covered by the mound.

Before making the mound, form a cone of soil in the shallow hole, and spread the tree's roots evenly over the cone. Then cover the roots to form the raised mound. Scrape up healthy soil

from around the tree to do this, or gather some from an unused portion of the yard. You can add some soil-texturizing amendments to improve soil-drainage.

Watering

Upon planting, water the mound once. I soak the planting mound and carefully step on it to eliminate air pockets in the soil, which will kill new-feeding root hairs. You can make a moat-like watering basin on the top of the mound for this initial irrigation, but the basin should be filled with soil after the water has soaked in.

Next, spread a 3- to 6-inch layer of mulch (straw, rotted wood chips, and decaying leaves) around the planting mound. Make sure the mulch doesn't press against the trunk, as it may promote rot. In dry climates, the wider and deeper you make the circle of

mulch, the quicker the nutrient-gathering roots will spread from the trunk.

If you ever water the tree again, do so beyond the "dripline," or edge of the canopy, to encourage wide roots and a healthy tree. After planting, I usually give the tree two or three waterings a week to help it build a sturdy trunk and primary branch system. After two or three years of watering, it'll do just fine on its own.

Staking

Never buy a tree tied to a stake. Such trees have wimpy trunks that are easily broken by high winds. Trees trained to a stake in the nursery, with the lower branches pruned off (to make a lollipop-shaped tree called a "standard"), are destined to have their foliage outgrow their root system, connected by a trunk with poorly developed girth. These weakened trees will be more vulnerable to wind and ice damage.

The natural form for many root systems, with the exception of young, tap-rooted trees like nut trees and oaks, is a number of large, horizontal roots that radiate outward. These horizontal roots remain within the top two feet of soil, while a series of vertical roots, called sinker roots, extend downward. This root pattern helps stabilize the tree. Proper planting and watering, which develops wide roots, is the best insurance against wind damage.

Never stake young, properly-sized trees, unless the wind is absolutely horrific. Then, use one or two stakes near the trunk. Fasten a figure-8 loop around both the tree and the stake. Under no circumstances should you tie the trunk so tightly to the stake that it can't move. Tree trunks held in bondage to a stake will develop much less girth, and are ultimately weaker. Make sure to put the figure-8 ties as low as possible on the trunk, while keeping the tree upright. Remember, nature creates the best trunk. So let her blow.

Now's the time to wax eloquent about trees. After the planting is over, it's time to care for the tree, learn from it, maybe even write a story or poem in its honor.



On Earth Day, trees took a bow.



This solitary, broad & living thing
Produced too slowly ever to decay;
Of form and aspect too magnificent
To be destroyed!

Joined in one solemn and capacious grove,
These trunks stand each particular trunk a growth
Of intertwined fibres serpentine
Up-coiling, and inveterately convolved;
Not ornamented with Phantasy, and looks
That threaten the palace.

Great Trees by William Wordsworth



GETTING RID OF GARBAGE

Ed Martin leans against his Peterbilt cabover, eyeing the 3,000-pound blocks of compacted garbage being fork-lifted onto its 42-foot-long tractor trailer. He had spent the previous night in his cab's sleeper berth at a Queens, N.Y., warehouse after hauling a load of steel bars from Ohio to New York City. Now, twenty minutes after backing into the loading area at the Star Recycling transfer station in Brooklyn, N.Y., Ed will point his giant rig westward for a 440-mile trip to the Willow Creek landfill outside of Atwater, Ohio (pop. 800).

On the road, only state transportation inspectors will know that his cargo is a 47,000-pound mass of used paper cups and soiled mattresses, shards of sheetrock, rotting banana

peels, and other debris that's been picked clean of recyclables. At the Willow Creek dump, he'll join more than 90 other trucks that disgorge up to 1,900 tons of out-of-state garbage each day. A look of scorn creases Ed's weathered face as he anticipates the inspections at Pennsylvania weigh stations ("they hassle you when they see it's garbage"), and the goatlike scent exuding from the rubbish after the 9-hour trek. "Garbage is the best paying freight around, but if I had my way, I'd be going back empty," he grouses.

Ed's massive rig is just one of the thousands of trucks long-hauling rubbish from the East Coast to the American heartland. Faced with soaring dumping fees and shrinking landfill space, in 1989 private carters in New York and New Jersey trucked

13.4 million tons of garbage over hundreds of miles into states like Indiana, Ohio, Pennsylvania, and Kentucky.

Every hour of every day in the year, about 43 tractor trailers, each burdened with about 20 tons of New Jersey's garbage, roll onto the state's roadways, bound for landfills scattered throughout the Midwest and the South. The cost to New Jersey taxpayers is enormous — Allen Moore, president of the National Solid Wastes Management Association (NSWMA), puts the figure at \$700 million over the past six years.

Realizing that the East Coast's waste threatens to overwhelm the Midwest's landfill capacity, many states are legislating roadblocks to slow the influx of garbage. But mid-western and southern states are send-

Truckin'



Star Recycling transfer station, NYC: Garbage, fresh from the streets, is dumped and loaded onto conveyors.

BY BILL BREEN • PHOTOS

ing millions of tons of their own trash out on the road! Missouri estimates it ships 34 percent of its municipal solid waste to landfills in Kansas and Illinois. (Illinois also ships to Indiana, Kentucky, Michigan, and Wisconsin.)

All but 12 states are garbage importers and exporters. One reason for the waste trading is found in that oft-heard, overly simplistic lament: "We're running out of landfill space." Sure, some urban areas lack the land for burying or burning much of their waste, which is why, say, St. Louis and Kansas City, Mo., are scouting landfills in other states. But in a nation as vast as the U.S., there's plenty of open countryside for garbage disposal, which is why St. Louis and Kansas City can ship to facilities in Illinois and Kansas — even as four other

states ship to Missouri.

"People here have got to realize that this is more than just a Midwest versus an East Coast issue," says Scott Holste of the Missouri Department of Natural Resources.

Supplies and Garbage, Protected Equally

To some degree, trucking garbage is a regional issue requiring regional cooperation. But to a great extent it really does pit the East Coast — specifically New York and New Jersey — against the rest of the country. Together, the two states were responsible for 53 percent of the estimated 15 million tons of waste shipped via the interstate system in 1989.

Southern and midwestern states

"I DON'T MIND HAULING IT AS LONG AS I DON'T HAVE TO TOUCH IT. ONCE I'M ON THE ROAD, NO ONE BUT ME KNOWS I'VE GOT GARBAGE ON BOARD."

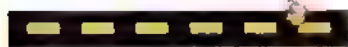
Trash



Pickers pull recyclables, while Ed Martin (above) and Mike Hall (left) truck the leftovers to Ohio and Virginia.

BY STEPHANIE BERGER

"PEOPLE [IN MISSOURI]
THINK THAT EAST
COAST GARBAGE IS
DIRTIER — FILLED WITH
SYRINGES AND
HAZARDOUS WASTE —
AND THERE'S TOO
MUCH OF IT."



seeking to stymie the invasion of imported garbage cannot turn to the federal government. The feds have virtually no control over the interstate movement of municipal solid waste. As the journal *Environmental Law* notes, "...every article of commercial activity (minnows, cantaloupes, scrap, timber, and yes, even garbage) is considered an article of commerce, and its interstate movement is constitutionally protected..."

Ironically, a thwarted attempt by New Jersey to ban out-of-state trash from rolling into its own landfills has impeded other states from blockading New Jersey's waste. In the early 1970s, Philadelphia trucked most of its garbage to New Jersey's southern landfills. This appalled members of the New Jersey State Legislature, who passed a statute prohibiting waste importation. In 1978, the U.S. Supreme Court struck down the statute in a prophetic ruling: "Tomorrow, cities in New Jersey may find it necessary to send their waste into Pennsylvania or New York for disposal, and those states might claim the right to close their borders. The Commerce Clause will protect New

Jersey in the future, just as it protects her neighbors now, from efforts by one state to isolate itself ... from a problem shared by all."

Having closed more than 300 landfills over the past 20 years, which were either too polluted or just too full, New Jersey exported 5.5 million tons of garbage in 1989. And with only 11 regional landfills remaining and an ambitious, statewide recycling program that's still in its infancy, New Jersey's garbage exodus shows no sign of abating.

Farmers and miners scattered across rural counties turn up their noses at the garbage convoys that come rolling over their verdant hills. "People here think East Coast garbage is dirtier — filled with syringes and hazardous waste — and there's too much of it," says Scott Holste of Missouri's Department of Natural Resources.

Last year, seeking to waive the Commerce Clause, U.S. Sen. Dan Coats (R-Ind.) introduced legislation that would have enabled states to seal their borders to imported trash. The bill passed in the Senate by a 67 to 18 vote, but it was later "killed in conference by New Jersey's senators," says Tim Goeglein, a spokesman for Mr. Coats. "Indiana is tired of being the trash bin for New Jersey."



At Star Recycling, the task is to keep the facility clean, and the garbage rolling.

Ironically, had Mr. Coats' bill become law, it could have been used to stem the flow of *Indiana's* trash into Illinois, Kentucky, Michigan, and Ohio. And garbage bans would devastate towns in northern New Jersey and New York's Long Island, where the highway is the only way out for their growing mounds of rubbish.

Garbage Flees New York

New York City, however, has another disposal option — the gargantuan Fresh Kills landfill on Staten Island. Fresh Kills has a lifetime that extends into the next century. So why are the City's private carters sending more than 7 million tons of commercial garbage over hundreds of miles to distant landfills? Solely because in 1988, the City more than doubled its dumping fee at Fresh Kills to approximately \$40 a cubic yard (roughly \$120 a ton) for garbage collected from restaurants, construction companies, department stores, and other businesses.

"The City said it was trying to conserve space at Fresh Kills, when it was really trying to raise revenues," says Allen Moore of the NSWMA. "Overnight, the garbage-shipping industry was born."

Enticed by southern and midwestern dumping fees that average about \$25 a ton, New York garbage brokers are converting empty warehouses and back lots into makeshift transfer stations where workers unload 25-yd. packer trucks (which pick up the City's commercial refuse), and load the waste onto tractor trailers for the long haul. "It's cheaper for me to send the garbage 1,000 miles away than it is to send it just a few miles to Fresh Kills," says Joe Bergeron, general manager of the Star Recycling transfer station in Brooklyn.

New York's two state inspectors are scrambling to keep track of the City's 183 (known) transfer stations. Glenn Milstrey of New York's Department of Environmental Conservation reports that inspectors are finding "numerous" environmental violations at many of the stations. Mr. Milstrey lists the Star Recycling transfer station as "one of the few that are [licensed] — they're one of the good guys."

Star Recycling is an \$11 million operation covering five acres, hard by the Brooklyn waterfront. Here, workers lean over conveyor belts that chan-

nel a constant stream of waste, pulling aluminum, metals, glass, cardboard, and high-grade paper from the 1,700 tons of garbage that roll into the facility each day. The rest of the garbage is sent packing, baled like hay. Each day, Star sends up to 80 tractor trailers, each laden with up to 23 tons of garbage, to landfills in Ohio, Indiana, West Virginia, and Georgia.

Every weekday, Star also railroads three boxcars laden with 270 tons of baled garbage to Lineville, Iowa, where workers unload the trash onto trucks bound for a privately owned landfill 55 miles across the Missouri border. Missouri officials call the landfill, near Trenton, a "sloppy operation." They're suing the landfill's owner, principally for failing to prevent contaminated rainwater from leaching through the dump and into a nearby creek.

Mr. Bergeron argues he wouldn't send waste to a dirty dump because, as the "garbage generator," Star Recycling might be held responsible for cleanup costs. Besides, until the lawsuit is settled, the Missouri landfill can legally continue accepting up to 3,000 tons of trash each week, regardless of where it comes from. And that angers Kathleen McCartney, a retired schoolteacher who lives nearby.

"We raise livestock here, and that landfill is leaking into our shallow well water," she says. "So what are we going to do — feed our cattle on bottled water?"

Responding to what she claims is an "inundation" of out-of-state garbage merchants seeking to build landfills in northern Missouri, Ms. McCartney has founded the Waste Information Network to help others in Missouri block imported garbage. "We're not opposed to building landfills to take care of our own waste," she says. "But we're not going to take care of someone else's waste, too."

Trash Knows No Borders

Many in the waste-disposal industry agree that it's ludicrous to send garbage rolling hundreds of miles. Trucking merely transfers waste from one state to another. At best, it's a short-term fix for getting rid of garbage. At worst, it's a waste of millions of dollars. Waste-disposal experts argue that the challenge is to shorten the long haul by fostering regional cooperation —

NY AND NJ VERSUS
THE REST OF THE
COUNTRY: TOGETHER,
THEY GENERATED 53%
OF THE 15 MILLION
TONS OF WASTE THAT
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STATE IN 1989.

neighboring states working together to solve the universal problem of garbage disposal. After all, garbage doesn't recognize state borders.

No matter how much waste they reduce or recycle, some towns will still have to truck the ash that's left after burning, or the garbage that can't be buried locally. And before we dump on New Jersey, we should recognize that it's the country's industrial "breadbasket." If Ohio and Indiana are going to take crepe soles and pharmaceuticals made in New Jersey, isn't it also fair that they take some of New Jersey's garbage? The problem, of course, is that they're taking too much.

Empowering states to levy a surcharge on imported waste — when federal regulators deem an exporting state lacks an environmentally sound disposal plan — may slow waste exportation. Yet until solutions are hammered out, and New York and New Jersey shoulder more of the responsibility for reducing, recycling, and siting additional disposal facilities, the trash will just keep on truckin'.

"I don't mind hauling it as long as I don't have to touch it," says trucker Tom Green as he climbs into his cab, bound from Brooklyn to Atwater, Ohio. "Once I'm on the road, no one but me knows I've got garbage on board."

MICROWAVE OVENS: An Environmental Hazard at Home?

In 1991, more than 80% of American homes will have a microwave oven. It is perhaps the most successful appliance introduction of the 20th century.

There's some evidence it might be right up there with other 20th-century miracles that, while solving one problem, created others: miracles like processed foods, additives, pesticides, and packaging. Some of these innovations were thrust upon consumers without much thought about the longer-term problems they create.

For example, there's some concern about the interaction between food and its wrappings in the microwave oven. The Food and Drug Administration is investigating "heat susceptor packaging," which allows crusty foods like pizza to get crisp. The temperatures within these containers reach 400 to 500 degrees F. — conditions not foreseen when the materials were originally approved for food use. A 1988 FDA Memorandum of Conference describes a "breakdown" of the packaging and states that "a considerable number of volatile components of the

heat susceptor packaging become indirect food additives" from microwaving. (At present it is not known if this is unhealthy.)

The plastic wrap that works best in microwave cooking, polyvinyl chloride (PVC), has been under suspicion for some time. Apparently the migration of plasticizers from PVC films to food is highest where there is direct contact between the film and foods with a high surface-fat content. Plastic-wrapped microwaved meats (specifically pork and chicken) measured the most contamination. Like the susceptor packaging, plastic wraps were approved for food use before microwave ovens were envisioned.

Most recently it was discovered that furans and dioxins migrate to food from microwaveable paper trays such as those that hold prepared meat dinners.

THE MICROWAVE MENACE

Packaging problems aside, what about the potential hazard of the microwaves themselves? Since 1971, microwave ovens have been required to meet government standards that include door interlocks to prevent operation if the door is open, and limits on the amount of microwaves allowed to leak from them. But all appliances eventually become worn or malfunction. Microwaves can escape if the door seal is loosened, or is disrupted by food debris or a paper towel. If a gas burner malfunctions, you can see it or smell it. But there is no such evidence if a microwave oven starts to emit radiation.

Several reports have been published of radiation injury to the hand and arm while stirring food or removing containers. It's debatable how many injuries are caused by radiation exposure. Proof of an accident is difficult because microwave burns don't produce skin destruction as a fire burn does. The damage is to the peripheral nervous system beneath the skin. The microwave industry defends itself on this "lack of proof" basis. But at least two treating physicians report that patients who received radiation burns during a brief exposure of about five seconds experienced persistent neurological damage to the area

BY DAVID GOLDBECK

even after the skin healed.

The story of microwave emission standards is a disquieting one. According to a 1980 article in *Science* magazine, the standards were established in the 1950s when research on microwaves was just beginning — by those concerned with military applications, where risk is inherent and accepted, not by medical or environmental experts, who strive for zero risk. *Consumer Reports* tests have shown microwave leakages to be within government standards. The trouble, according to editor Louis Slesin of *Microwave News*, is that “no-body knows where the threshold for ill effects really is. In my opinion, microwaves play a role in the development of cancer ... we don’t know how little it takes.”

A 1988 report from the National Institute of Environmental Health Science cited microwave ovens as one source of potentially hazardous electromagnetic fields (nonionizing radiation). The report states, “Exposure possibly may affect the nervous system and susceptibility to chemical exposure.” And the 1990 draft report from the Environmental Protection Agency sought to classify electromagnetic fields a “probable human carcinogen,” placing them in the same category as PCBs, DDT, and formaldehyde. At this writing, that classification has been deleted from the EPA report (for technical and possibly for political reasons).

A PERCEPTION OF SAFETY

In many homes, children are allowed to operate the microwave without supervision because of their perceived safety as compared to electric and gas stoves. But there is a danger of burns, besides the unknown radiation dangers described above. In 1988, the Consumer Product Safety Commission estimated 2,352 thermal and scald burns from microwave ovens. In sheer number, that’s less than one-sixth of the burns attributed to gas and electric ranges with ovens. But numbers don’t tell the whole story. According to Matthew Maley of the Shriner’s Burns Institute in Cincinnati, conventional cooking units are more broadly distributed, are used

more often, and are more often employed in high-risk cooking.

Mr. Maley’s contention is that “oven users do not understand that microwaves heat in a way completely different from conventional heating appliances. This results in actions which would probably not be considered by someone using an ordinary cooker. Haste and an attitude that microwave ovens are safer likewise results in injury.” One safety problem that’s unique to microwave ovens, described by the Shriners’ report, is the so-called “eruption” phenomenon. When clear liquids are heated in glass, ceramic, or smooth plastic containers, the liquid can become extremely hot even though it doesn’t actually boil, and can erupt violently when moved or stirred, or when something (like a spoon or instant coffee) is added to it.

How much exposure you get, whether to microwaves themselves or to byproducts of packaging, depends on the volume of use. Consider that the Food Safety and Inspection Service (FSIS) tells us the industry projects 4.7 billion “trays, cylinders, bowls, and cups” will be sold each year for use in microwave ovens. That statistic, of course, brings up yet another downside of microwaving — the solid-waste issue. Processed microwaveable foods are among the worst culprits of over-packaging.

David Goldbeck, author of *The Smart Kitchen*, worries that “we are in the process of microwaving away 50,000 years of glorious culinary history in a dubious quest for convenience.”

READ THIS: MICROWAVE SAFETY

- 1) Unplug oven when not in use, and don’t store things in it.
- 2) Don’t install it over a conventional cooktop. Heat and steam may cause dangerous electronic malfunctions.
- 3) Don’t use the door as a shelf or lean on it. Misalignment could cause radiation leakage.
- 4) Don’t cook foods with unpunctured skins (like eggs or whole tomatoes) — they may explode. For the same reason, don’t overcook low-moisture foods (like baked potatoes or popcorn).
- 5) Don’t use it for the primary cooking of poultry, meat, or fish. Microwaving is not always effective at killing harmful bacteria.
- 6) Don’t use it for canning (may not prevent botulism; jars can explode), sterilizing (not suitable), or deep frying (too dangerous).
- 7) Don’t warm baby bottles in the microwave. Contents can become dangerously hot or have hot spots, and the plastic liners can explode when handled.

The Greening of Jay Hair

Jay Hair built a career around getting people to trust him. Yet he could be the least trusted environmentalist in America.

"Y

ou have to realize how a government agency really works," says a friend of mine, an environmental lawyer in Washington, D.C. Skittish about having his name in print, he is nonetheless trying to help me understand the role of Jay D. Hair, the president of the 5.8-million-member National Wildlife Federation, and one of the most visible environmentalists in the country. For ten years, Hair has fervently tried to bring environmentalists and business people together. He's built his career around getting people to trust him. Yet, to judge by his press clippings, he could be the least trusted environmentalist in America.

"Trust" is what my friend is trying to put into context. Consider, he explains, the Environmental Protection Agency, which must translate new laws (like the new Clean Air Act) into specific regulations. The top decision maker — which might be William Reilly, the EPA's director — has perhaps half an hour to review proposed policies on any particular point, from smokestack-emission specs to alternative-fuel guidelines. He uses research compiled under impossible deadlines.

"The decision maker can't [function]," claims my friend, "without some reliable people on the outside. He needs to call an expert and say, 'I may have to issue a set of rules on oxygenated gas, but I'm not sure what to do about it. What's your sense of appropriate policy?' The outsiders are people like Jay Hair, who have a large environmental group to brief them and presumably some time to reflect. They can say, 'Well, oxygenated gas is important this year. I think you should

push it.' And Reilly — or whomever — has something to go on."

If it seems like an egregious way to run a government, my friend is willing to defend it. Why not, he suggests, put someone with outside expertise in the loop, particularly if that person is credible? (Hair, besides managing a staff of scientists, taught ecology at North Carolina State University.) And if it means direct contact between the government agency and an environmentalist, well, corporate lobbyists are already pushing specialized viewpoints. Why shouldn't an environmentalist have equal access to decision making?

But last year, thanks to an incident at the EPA, Jay Hair's credibility came into doubt. He arranged a meeting between two friends: the CEO of a waste-disposal company and the EPA director. (More on this below.) The incident has focused attention on a question which many environmentalists are wrestling with: Should business, government, and environmentalists continue to be adversaries? And if not, what new relationship are they going to take on?

Jay Hair is a 45-year-old North Carolinian, a large man with intelligent charm, given to wearing pin-stripe suits. He is, as one former NWF board member told *Regardie's Magazine*, "so slick he should be hosting game shows." But I found him candid, direct, youthful. Every now and then, an almost goofy expression passes across his face, as if he can't help but show the precocious youngster he once must have been. Indeed, his ideas are often boyishly simple: Let's find some television producers and get them to put environmental themes on the air. Let's mail oily rocks from Alaska to Exxon. Better yet, let's invite Exxon chairman Larry Rawl to walk along the beaches of Prince William Sound with us. (Rawl agreed to go if the press didn't follow, and then he backed out.) And in an interview, let's disarm the credibility issue



BY ART KLEINER

straightaway: "We [meaning the National Wildlife Federation] live in a big glass house and we throw a lot of stones," he says. "We ought to hold ourselves to a higher standard. If we're going to talk the talk, we've got to walk the talk."

For at least a decade, the National Wildlife Federation has been split between the hunters and fishermen who were its traditional members, and the liberal activists drawn by the group's top-quality publications, *National Wildlife*

and the kid's magazine *Ranger Rick*. Hair, when first appointed in 1981, was seen as the liberals' candidate. But he became expert at keeping the conservatives and liberals in relative harmony, even though Reaganites occasionally described him as a political opportunist who sold out the NWF's free-enterprise ideals.

Far from abandoning free enterprise, Hair approached

When Exxon declared Prince William Sound environmentally stabilized, Jay Hair said: Let's send oil-coated rocks to their corporate headquarters.



AP/WIDE WORLD PHOTOS

*Waste Management Inc. is pushing
for tougher environmental laws,
but tougher laws serve them — they
discourage smaller competitors.*

big business directly. One of his first projects, the Corporate Conservation Council, was a quarterly gathering where senior-level executives met off-the-record to discuss environmental problems and possible solutions. The group focused on non-controversial items, such as a project to preserve wetlands on corporation-owned land. The Wildlife Federation handpicked the members, and charged each company \$10,000 to take part. The money was kept separate from the rest of the Federation's income, in part so the NWF could feel free to sue those companies, which it occasionally did. The Council's impact was so inconspicuous it seemed nonexistent. "Did the companies change their ways?" says one cynical NWF staffer. "No. Did they learn how environmentalists think? Yes."

However, to judge from conversations with executives who took part, the CCC didn't so much teach executives how environmentalists think as give them a glimpse of their own complicity. In 1986, the CCC offered a prize for environmental achievement, recalls CCC Director Barbara Haas. Several companies nominated themselves, simply because they met environmental regulations! Now they know better. A tiny victory, but a victory nonetheless.

Within the National Wildlife Federation, the CCC remained self-contained. But to outsiders, it came to symbolize how the Federation — and Hair — were adopting big-business trappings. Hair took a \$200,000 salary, peppered his conversation with references to well known people, and continually tried to boost NWF's budget and prominence in corporatesque ways. He hired competent people and paid them professional-level salaries, arguing that they should build lifelong careers without burning out in typical non-profit style. The new NWF headquarters he instigated takes up a full city block, housing people at in-laid, mahogany desks.

The NWF paid for all this with a \$78 million annual income, the bulk of which came from selling magazines

and school materials. Like several other mainstream groups, the NWF also took donations (totaling about \$400,000) from corporations. One of the Wildlife Federation's leading contributors was Waste Management, Inc., a company that operates incinerators, hazardous-waste sites, and landfills throughout the country. Dean Buntrock, the head of WMI, joined the National Wildlife Federation's board in 1987, and he and Hair became friends.

Then, last spring, two EPA staffers claimed that Hair engineered a break-fast meeting between Buntrock and the EPA chief, William Reilly. A month after that encounter, Reilly re-opened a dormant 1985 case in which the North Carolina State Legislature refused (in effect) to permit a new hazardous-waste incinerator approved by the EPA. Waste Management wasn't directly involved in the case. But as the *Village Voice* noted, reopening the case might have led to looser restrictions on

siting hazardous-waste facilities throughout the South, making the region a dumping ground for out-of-state toxics, to WMI's apparent advantage.

Hair argues that Buntrock "not once, privately, publicly, or otherwise, never in a conversation" tried to influence his position or that of the NWF. In fact, Hair (and the NWF) opposed Reilly's move to re-open the case. Hair claims he simply wanted Reilly and Buntrock to discuss recycling and hazardous waste transportation generally — hence the troubling detail of a note leaked from the EPA, written by Hair to Reilly in the margin of a newspaper on toxic-waste disposal in the South.

Helping people "get to know" each other is a longstanding NWF strategy. And it has led to demonstrably good results. Hair is known for using his group's conservatism to bring such controversial ideas as population control, and such esoteric ones as species diversity, to mainstream audiences. A new CCC program introduces business-school classes to case studies with an ecological ethic. The "Community Right to Know" aspect of the 1986 Superfund amendment, which requires corporations to disclose their pollutants, was written by a National Wildlife Federation lawyer, whom Hair introduced to lawmakers. Hair convinced Dow Chemical managers to respect public opinion; and he convinced prime-time TV producers to incorporate environmentalist themes.

"Jay Hair is one of the few people who can get into those doors," says Ann Krumboltz, the NWF director of Earth Day programs.

Nor has Hair always backed down from confrontation. When Du Pont and Monsanto spent \$300,000 and \$400,000 respectively to defeat California's "Big Green" initiative, all the while calling themselves "environmentalist" companies, Hair wrote their chief executives in protest. He has twice stood up to major oil companies on the Corporate Conservation Council; in both cases, the companies resigned. The first case was in 1988, when Arco wanted the

Ranger Rick cleans up: Most of NWF's cash comes from magazines and school supplies.



Talking the talk: In 1982, Hair charted the Reagan administration's "knife job" on the EPA's budget.

NWF to support oil drilling in the Alaskan Wildlife Refuge — the organization refused. After the Valdez oil spill, Hair became a vociferous critic of Exxon — pushing for double-hull tankers, collaborating (with the Natural Resources Defense Council) in a joint civil suit against Exxon, standing up at a shareholders' meeting (in 1990) to call for chairman Lawrence Rawl's resignation. At that time, Rawl said to him, "It was a bad oil spill, but it was *just* an oil spill. Why are people so angry?"

But the Waste Management case is different. For one thing, what's the rationale for putting Dean Buntrock on the NWF board? Hair says it was meant to foster diversity — to add another viewpoint. By involving a company in environmental work, he reasons, you influence the company to change its ways.

In environmental circles, the mere mention of Waste Management polarizes people. I've heard people claim that Buntrock's company is merely trying to bring cleaner practices to a dirty, mob-ridden industry; others dismiss the company's environmental efforts as "greenwashing." WMI has consistently pushed for tougher legislation, but tougher legislation serves them — it discourages smaller competitors.

"There has not been one lawsuit filed against Waste Management," says Hair, "that has to do directly with environmental degradation. All of these are anti-trust kinds of issues." Hair says he's made a standing offer to environmental groups: "If they present me with the data to back up claims of environmental abuse or groundwater contamination at any WMI facility, I personally will have the NWF file a lawsuit against Waste Management."

I called people at three of Hair's harshest critics: Greenpeace, the Citizen's Clearinghouse for

Hazardous Waste, and the U.S. Public Interest Research Group — and none admitted hearing his offer. In any event, now the offer is public. Perhaps now someone *will* provide Hair with evidence, and he'll go after WMI as he went after Exxon. Or he'll use the "get to know you" method, and bring everyone together to resolve the problem outside the courts.

It's hardly news that many environmental groups are going through internal gyrations about taking corporate money. But if it's naive to think that the money comes with no strings attached, it's also naive to think (as a Citizen's Clearinghouse for Hazardous Waste staffer told me) that the only true way to stop polluters is to put them in jail. Perhaps white-collar fellows should go to jail, but like all criminals, they tend to revert without education. The NWF has done a great deal to educate business people. They influence the business world in part because they're the same sort of people: young professionals with the dignity, as Hair says, which comes with amenities and a good salary.

Paradoxically, Hair recalls his feeling standing in Exxon chairman Larry Rawl's top-floor office in New York, looking down at the tiny cars and people. "It became so apparent to me what incredible disconnect people have," he says, "who have grown up in Exxon's kind of culture." He brushed aside the obvious irony, that

his contacts and professionalism make him just as disconnected from everyday people. I didn't think to ask, to my later regret, whether he wondered if dignity should depend on professionalism.

The problem of fixing appropriate pay for appropriate work underlies all professional endeavors, and it's wreaking havoc in many corporate-reform efforts. (Roger Smith's golden parachute, for instance, was a tremendous morale-drain for the people trying to improve General Motors.) As the eminent business writer Peter Drucker points out in a recent interview, business people have learned to measure their worth not by how creative they are, nor even how much wealth they generate, but what sort of deals they make.

What, then, should an environmentalist earn? Should that depend on what sort of deal he or she can make? Should it depend on his or her ability to generate wealth? Or should it depend on some other need? Unfortunately, Jay Hair's most valuable skill (as the Waste Management episode points up) — helping the world of mainstream business and government learn about its own complacency — is hardly marketable at all.

Art Kleiner is a regular contributor to **GARBAGE** on issues pertaining to corporate environmental policies. Last year Art began working on a book called *The Age of Heretics*. It will be published by Doubleday in 1992.



AP/WIDE WORLD PHOTOS



Trading Trash, Losing Trees

International Users of Renewable Energy*

Energy derived from renewable sources, worldwide: **17%**

Energy derived from renewable sources, by nation:

Norway.....	43%
Sweden.....	27%
Australia.....	9%
United States.....	8-9%
Germany.....	5%

(*Renewable energy defined as wind power, solar thermal, hydropower, biomass, geothermal, ocean power, photovoltaics.)

(Source: Rocky Mountain Institute, Worldwatch Institute)

Interstate Garbage Trucking

Total solid waste shipped, 1989: **15 million tons**

Leading solid-waste exporters, 1989:

New Jersey.....	7.5 million tons (53% of total shipped)
New York.....	2.4 million tons (16% of total shipped)

Tons of solid waste imported by New Jersey: **0**

Tons of solid waste imported by New York: **0**

(Source: National Solid Wastes Management Association)

Total toxic waste shipped, 1988: **223,588 tons**

Leading toxic-waste exporters, 1988:

New Jersey.....	13,549 tons
Pennsylvania.....	7,179 tons
Kentucky.....	6,804 tons
Massachusetts.....	6,728 tons
West Virginia.....	6,671 tons

Leading toxic-waste importers, 1988:

Ohio.....	15,131 tons
Louisiana.....	11,599 tons
Alabama.....	7,925 tons
South Carolina.....	6,214 tons
Tennessee.....	5,623 tons

(Source: EPA)

Miscellaneous Facts

Number of times the "no animal testing" claim appears in the *Body Shop* catalog:

17

Households in the Eastern half of the U.S. served by curbside pickup of recyclables, 1989:

7.2 million

Households in the Western half of the U.S. served by curbside pickup of recyclables, 1989:

1.8 million

Estimated production of plastic packaging-materials, 1980:

4.6 million tons

Estimated production of plastic packaging-materials, 1987:

6.9 million tons

Total increase in plastic packaging-materials, 1980-87:

50%

(Source: COPPE)

Federal Tree-Cutting versus Federal Tree-Planting

Logging on federally owned land, 1989:

Northeast & Great Lakes.....	113,575 acres
California & Pacific Northwest.....	445,057 acres
The South.....	132,638 acres
Rocky Mountain, Midwest, & Southwest.....	310,538 acres
Total.....	1,001,808 acres

Planting on federally owned land, starting 1991:

Northeast & Great Lakes.....	57,361 acres
California & Pacific Northwest.....	19,328 acres
The South.....	127,913 acres
Rocky Mountain, Midwest, & Southwest.....	140,307 acres
Total.....	344,909 acres

(Source: U.S. Forest Service)

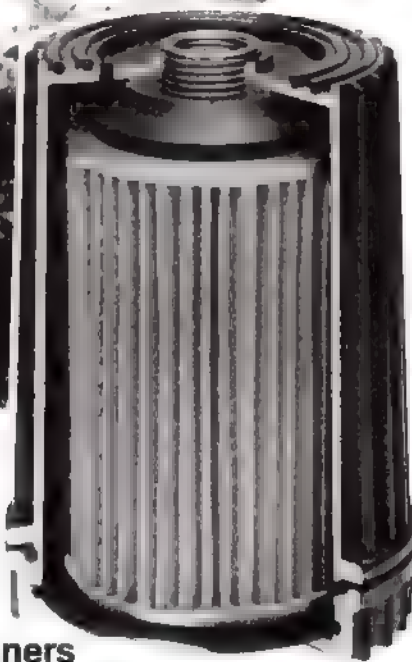
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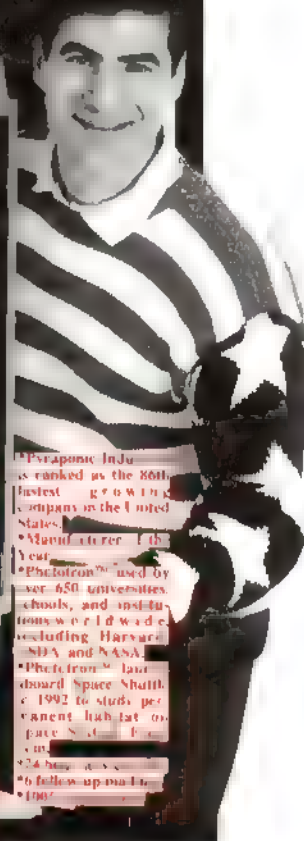
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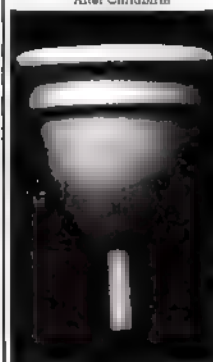
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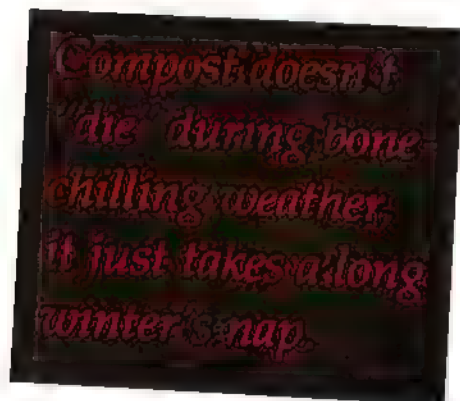
A garbage troika: What happens to cold compost, sewing scraps, and luxury-liner litter?



Q: Living in central Wisconsin means dealing with Arctic-like conditions this time of year. Do composts survive winter?

Jean Abreu
Wausau, Wis.

A: Compost doesn't "die" during bone-chilling weather; it just takes a long winter's nap. Kitchen scraps



and yard waste usually stop decomposing when the compost pile's internal temperature falls below approximately 50 degrees Fahrenheit. (Compost thrives when the pile's internal temperature ranges from 113 to 158 degrees Fahrenheit.) When air temperature drops, compost temperature drops and biological activity in backyard piles slows down or ceases completely. A compost pile begun in August or September may not be ready for your garden until April or May.

Generally, the larger a compost heap, the more heat it generates internally, and the more resistant it will be to the cold. Make sure that new compost piles are at least three feet high. (Piles larger than five feet high by five feet wide may produce enough heat internally to remain active throughout the winter.) To cut a few weeks from your compost heap's winter slumber, some gardening experts recommend insulating smaller piles with a three- to four-inch layer of soil or straw. This natural blanket retains heat and escaping nitrogen, an essential ingredient of good fertilizer. Plastic is also a useful insulator. It protects compost from oxygen-depleting rain and snow, which often saturate the pile.

Cyane Gresham, a research technician at the Rodale Research Center in

Emmaus, Pennsylvania, reports that winter compost should only be turned when absolutely necessary (such as when a pile becomes waterlogged). Rotating a pile causes the internal temperature to plummet, further slowing decomposition. Adding new organic material to the pile's interior during cold weather is likely to have the same effect, so layer new compostables only on top of your pile.

Q: I sew a lot. I use leftover fabric for piecework and arts-and-crafts projects, but I still have a lot of scrap that usually ends up in the trash. Does anyone use rags anymore to make paper or other materials?

Kim Telsing
York, Penn.

A: Fortunately, the ragman hasn't gone the way of the iceman. Each year, professional rag merchants procure hundreds of tons of waste fabric from the apparel industry's factory floors. They then separate and bale it according to content, and sell it to industries that create new products from it (like paper).

Some fine quality stationery is made from remnants of discarded cloth. Pulp for "rag-content" papers is produced from 100-percent cotton fabrics like denim and muslin. Recycled fabric is also used to make felt for automobile interiors.



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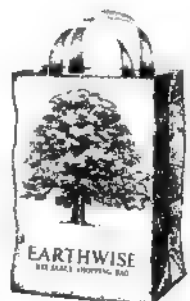


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In most parts of the world, cruise-boat sewage is pumped directly into the ocean.

And some rag dealers cut scrap into 12-inch-square pieces, and sell them to the automotive industry for use as wiping cloths.

While it's easy for industry to keep fabric scrap out of the local landfill, it takes some leg work

for individuals to do the same. Of the seven rag dealers we phoned, none accepted remnant cloth from individuals. How come? It's not cost effective for dealers to sort and separate mere pounds of scrap. Moreover, a mixed bag of material from, say, a seamstress contains too many types of unidentifiable cloth, making the fabric useless to many potential buyers.

To get rid of your scraps without trashing them, try

the following: First, check the Yellow Pages for area cleaners in the unlikely event that they collect scrap from individuals. A better bet is to contact your local branch of the Salvation Army. According to a spokesman, 1200 Salvation Army community centers across the country accept fabric scrap in any quantity. Affiliated women's groups do a lot of quilting, and scraps are always welcome. In addition, the organization saves, separates, and bales the scrap for future sale to rag merchants.

Q: What happens to all the garbage produced on cruise boats? Is it just dumped at sea?

Michael Korngold
Minneapolis, Minn.

A: Trash disposal at sea is regulated by MARPOL, an international treaty developed in 1973 to promote a safer and cleaner marine environment. The treaty is comprised of five sections, each of which monitors the disposal of a specific waste product: oil, chemicals, packaged hazardous materials, sewage, and garbage. Countries participate in MARPOL voluntarily. Until 1987, any nation that signed the treaty needed only to abide by regulations for the disposal of oil and chemicals.

Since December 1988, MARPOL has added tougher regulations for disposing of trash from cruise boats, recreational vessels, and naval and freight ships.

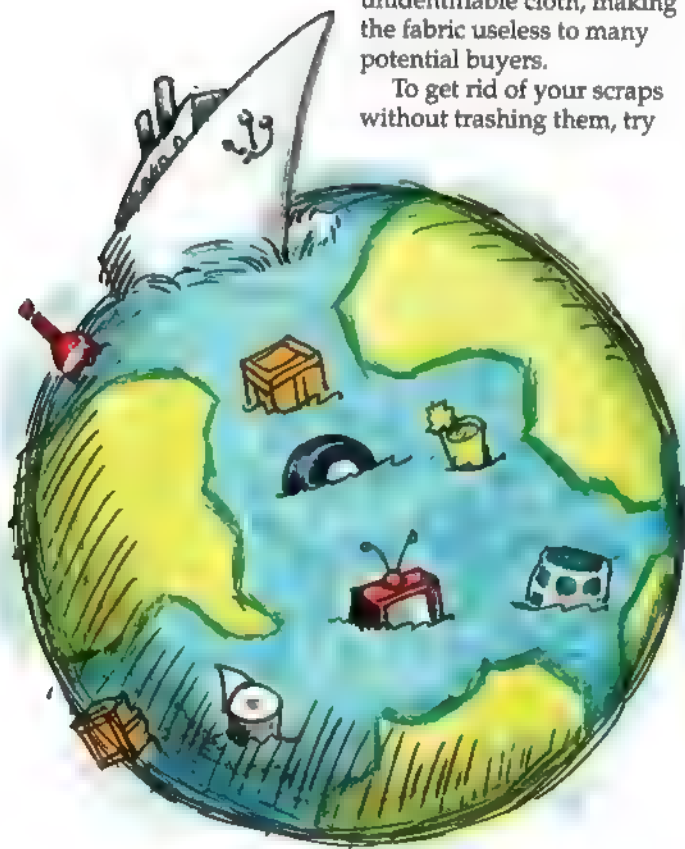
While participation in the rules governing the discharge of hazardous packaged goods and sewage remains optional, the regulations pertaining to the disposal of garbage are now mandatory for all treaty members.

Under MARPOL, it is illegal to dump plastic *anywhere* in the ocean. As a result, luxury liners now contain separate bins for plastic wastes, which are returned to shore and land-filled or incinerated. The treaty also prohibits the dumping of paper, rags, glass, crockery, metal, and food into waters that are within 12 miles of a country's coastline. These items are typically ground up and dumped beyond the 12-mile mark. A violation can result in a \$25,000 civil penalty, a \$50,000 criminal fine, and a five-year prison term. Approximately 60 foreign vessels are under investigation for illegal garbage dumping.

Unfortunately, in most parts of the world, cruise-boat sewage is still pumped directly into the sea. Under the Clean Water Act, however, it is illegal to dump sewage within three miles of the U.S. shoreline.

GOT A QUESTION?

Write to: Questions Editor



Of Dumps, Bioregions, and Solar Buildings

BOOKS

Global Dumping Ground

by the Center for Investigative Reporting and Bill Moyers. 152

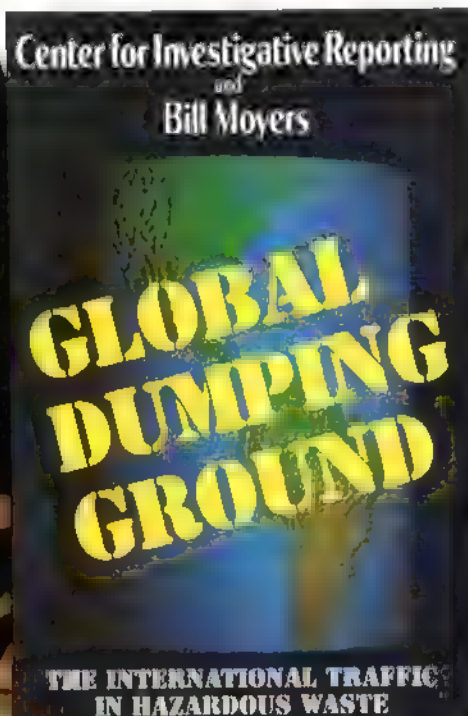
pages. Seven Locks Press, P.O. Box 27, Cabin John, MD 20818. Softcover, \$13.95 ppd.

Between 1986 and 1988, industrialized nations shipped three million tons of hazardous waste to the Third World.

Global Dumping Ground is first-rate environmental reporting that reads like a gripping detective story. Drawn from extensive inter-

views with EPA officials, FBI investigators, and imprisoned waste exporters, the book's subject is the big business of marketing hazardous waste to Third World countries, where toxics regulations are seldom enforced. The result of four years of muckraking by the San Francisco-based Center for Investigative Reporting, *Global Dumping Ground* is the expanded companion text to the PBS documentary of the same name, which aired last fall.

The book focuses primarily on increasing U.S. involvement in the multi-million-dollar waste trade. Here, rising disposal costs and lenient regulatory policies have encouraged the growth of chemical-waste exports. Once dealers find overseas customers for their commodities, there is little that can be done to abort the transactions. Between 1986 and 1988, more than three million



U.S. AID

tons of hazardous waste, including cadmium batteries, PCB-laden solvents, and banned pesticides such as DDT, were shipped from the industrialized world to less developed nations. Surprisingly, the EPA lacks the power to stop toxic shipments, even if it knows the recipient country is incapable of responsibly managing the substances.

It's illegal, however, to label and ship unusable hazardous waste as surplus chemical material. It was this regulatory loophole that landed the Newark, N.J.-based Colbert brothers — the forerunners of the chemical-waste trade — a 13-year prison sentence. The team sold a mixture of ineffective, toxic liquid chemicals to a small firm in Zimbabwe which was promised dry-cleaning fluid. Prior to their arrest, the Colberts operated a \$10 million dollar-a-year waste hauling business that listed such clients as the U.S. Navy and the Treasury Department.

Global Dumping Ground raises some obvious questions about where the responsibility for putting an end to toxic trading begins. The authors are wise to point out that the problem goes beyond inadequate regulation and insufficient policing. As long as we keep producing such vast quantities of hazardous waste, the big business of chemical export isn't going to disappear. — *Ginia Bellafante*

Whatever Happened to Ecology?

by Stephanie Mills. 253 pages. Sierra Club Books, 730 Polk St., San Francisco, CA 94109. Hardcover, \$18.95 (members subtract 10 percent), plus \$3 shipping.

Does ex-Earth First!er Dave Foreman make you feel like a sissy? If getting bellicose with a bulldozer isn't your style, curl up with this book. Disguised as a lively autobiography, it's actually a hefty manual on personal environmental action.

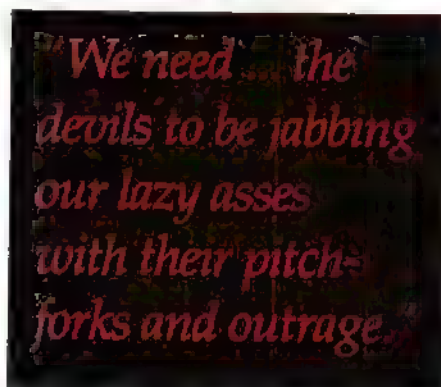
Ms. Mills' life story makes fun reading. Her 1969 Mills College commencement address on overpopulation jolted her into the national spotlight in her early 20s. She spent the ensuing decade writing and editing for such publications as *CoEvolution Quarterly*

and *Friends of the Earth's Not Man Apart*, trading theories with a bumper crop of environmental heroes.

With a disarming willingness to laugh at herself, she chronicles the evolution of her environmental consciousness. In the beginning, she's a fiery crusader. After being knocked off her horse a few times — in one tilt, she discovered that not all Friends of the Earth members agreed with her that apartheid was a good reason to boycott a Johannesburg environmental conference — she becomes more, well, understanding. But by the end of the book's first section, "Theory," she's ready to make a move.

In "Practice," the second half of the book, she gets her wish. She falls in love with a bioregional activist, pulls her roots out of the San Francisco bioregion, and plunks herself down in Michigan's Maple City, her new husband's hometown.

Bioregionalism, a slippery term, advocates a sustainable lifestyle within an area's geolog-



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ical boundaries (such as mountain ranges and watersheds). In practice, it turns out, bioregional utopia isn't easy to achieve. If, say, one man builds a golf course on his part of a river, his pesticides and fertilizers may permeate the whole bioregion. And a person raised on movies, imported fruits, and major appliances will certainly have trouble adjusting to a simple life limited by the resources of a northern bioregion. Unable to shut her door on the world, the writer asks, "How do you come up with a soul that's willing to go all the way?"

Ms. Mills' wry patience with her own shortcomings is equally distributed among the countless Earth-saving philosophies that her book introduces. Measured against her own definition, the book functions as a peacemaker, "abjuring physical, or even rhetorical violence." But equally necessary are the devils, the Earth First!ers. To bring about change, she writes, "We need the angels to be gliding serenely on high, sharing their grace, and the devils to be jabbing our lazy asses with their pitchforks and outrage. Either constellation of virtues in the absence of the other would be inane."

—Hannah Holmes

Solar Building Architecture

Edited by Bruce Anderson. 352 pages. The MIT Press, 55 Hayward Street, Cambridge, MA 02142. Hardcover, \$40.00 ppd.

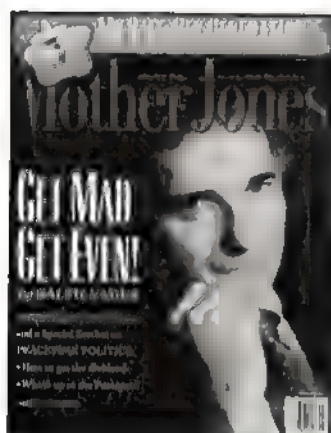
If our solar technology piece [see p. 24 — the editors] leaves you hungry for more information on experimental solar-home design, you may want to read the latest in a 12-part series on the fundamentals of solar-heat technologies from MIT Press. While the book is accessible to the interested layman, be forewarned that it's intended for those who are well versed in the language of solar-energy science.

A compilation of essays by eight architects and energy consultants, *Solar Building Architecture* is a technical analysis of the relationship between building design and the use of solar energy in both residential and commercial spaces. The book examines both the successes and failures of experimental solar design since 1973, the year the federal government initiated research

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—Ginia Bellafante

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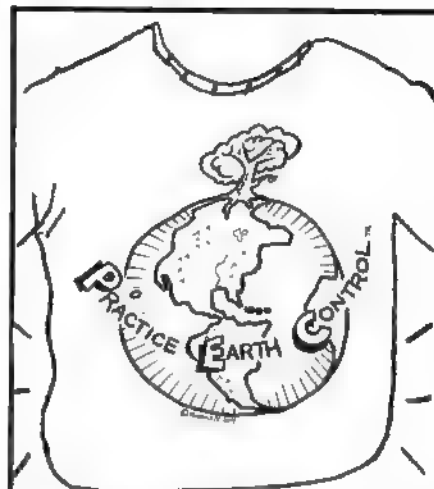
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— Hannah Holmes

Salt-Free Ice-Buster

Ah, winter. Softly falling snow. And lumpy shields of ice on the front steps and sidewalks. Before attempting to negotiate the gleaming stretch, you might grab for a bag of ice-melting pellets, or go straight for the Morton's salt. Neither move is great for the environment.

The snow-melting mixtures you buy in a bag are various kinds of salt: sodium chloride, calcium chloride, and potassium chloride. All these salts melt ice easily. The problem comes as the melted ice trickles into your garden, your lawn, or the storm drain, carrying the salts with it. Salty soil can kill plants by preventing them from taking up water. In a river, salts damage aquatic organisms. Calcium chloride is especially toxic to fish.

If you don't want to take a shovel and hack at the little Himalayas of ice, you might try sprinkling a salt-free ice melter. safe-t-thaw, a new product, looks like tiny mothballs. When safe-t-thaw's beads hit ice, they begin to wiggle. In seconds, they burrow beneath the surface, and the ice quickly weakens and becomes porous.

The beads are carbonyl diamide, which, according to its federally required Material Safety Data Sheet, is inert if swallowed, and presents no threat to waterways, cars, or gardens. However, it can irritate eyes and, for some people, skin. safe-t-thaw can be found at supermarkets, hardware and home-improvement stores, and nurseries. It retails for under \$6 for two 32.9-oz. shaker cans. Performance Industries, P.O. Box 812, Dept. GM, Richboro, PA 18954; (215) 355-7841.

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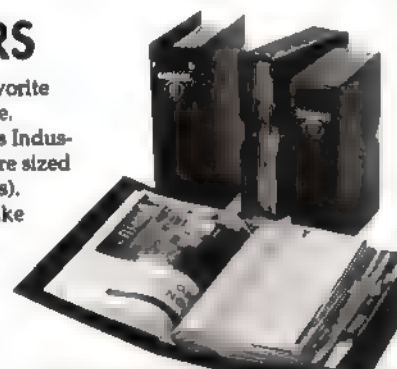
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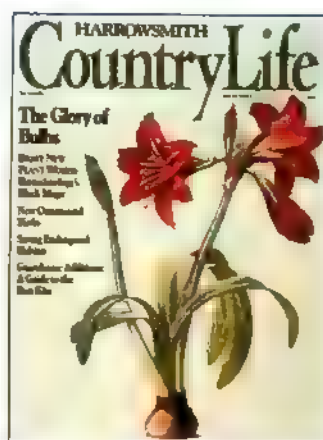
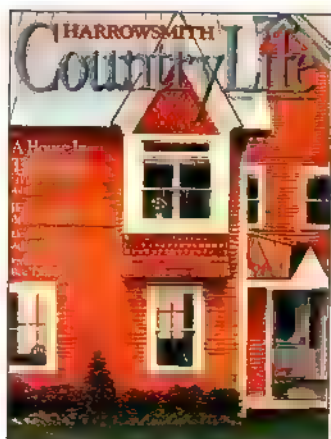
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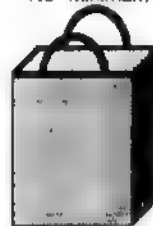
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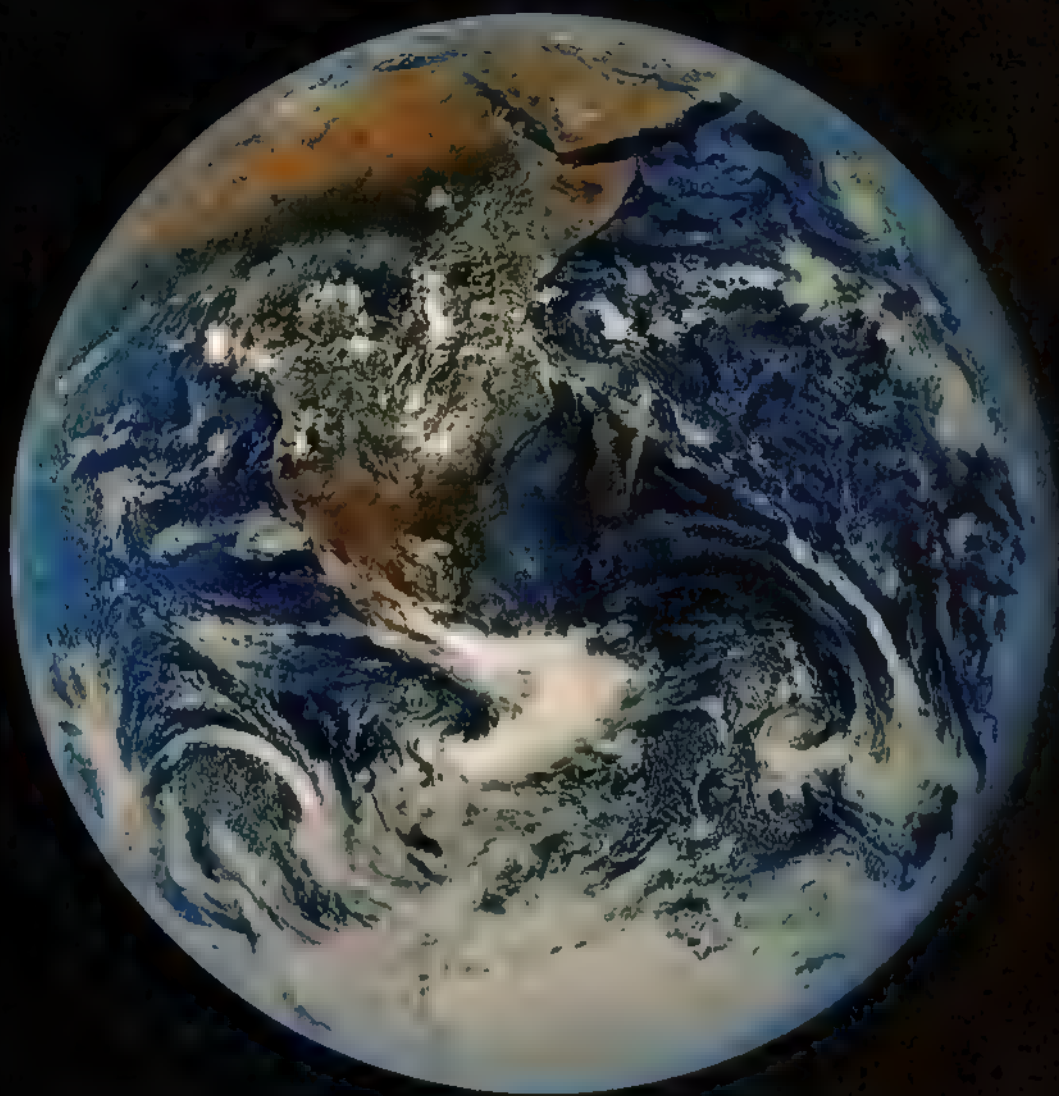
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Eco-Trash: Tacky Trinkets on the Trail of a Trend

It's as American as shrink-wrap to capitalize on a trend: Somebody's always ready to print up a batch of tee shirts or a slapdash book to squeeze a buck out of the latest movie or concert tour. The return of the Earth to the national spotlight is no exception.

While public concern for the health of the planet is at a peak, entrepreneurs are hustling Earth-related trinkets and gimmicks. Call it "eco-trash."

Even the best "green" mail-order catalogs and "ecology stores" offer an example or two. Ask

THE "REMINDER BRACELET" is marketed by some savvy kids who say it "reminds everyone who sees it to SAVE THE EARTH!!" It's pure plastic: plastic string, plastic hearts, plastic Earth. This bauble is definitely going to outlast your desire to wear it, kids, not to mention the world's known oil reserves.

THE INFLATABLE VINYL GLOBE has endangered species printed on it. It may be educational, but there are better ways. This beach toy could well end up in the water, where the animals it purports to protect could swallow it. Even if your dog pops it, it is instantly hard-to-recycle trash.

THE ENVIRONMENTAL SCIENCE KIT is educational, but the execution deserves an "F." The plastic fanny pack is stuffed with a block of plastic foam. Plastic film canisters, holding only a few snippets of test paper, are set into the foam. More plastic sheathes the "observation log." None of the plastic is coded to facilitate recycling.

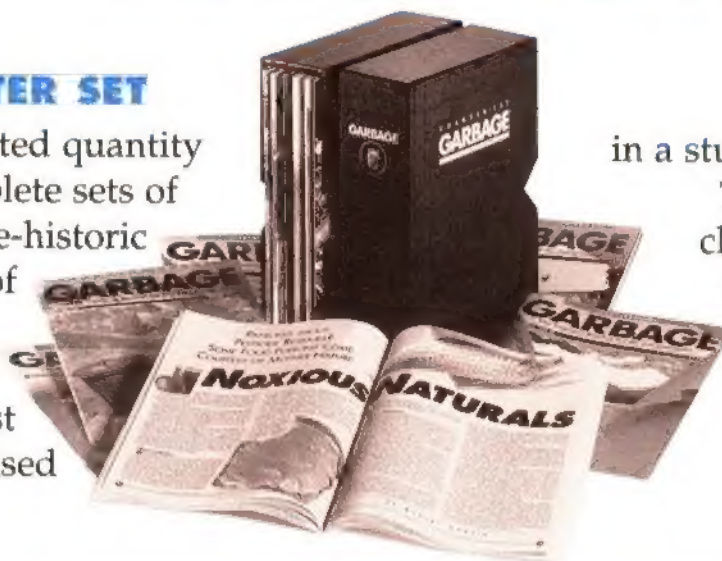
yourself a few questions as you peruse merchandise stamped with Earth-friendly slogans: Is it really useful? Is it well made? Does it really improve the environment? Presented with a mound of Earth-embossed merchandise, it's up to consumers to detect whether resources are being squandered on eco-trash. The examples illustrated above flunk the test.

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However, in city-after-progressive-city, people are waking up to the fact that we can't continue to treat our homes like hazardous waste dumps, and we can't continue to throw toxic chemicals out with the rest of the garbage.

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Winning Back the Woodpecker

Six years ago, the U.S. Forest Service counted only four red-cockaded woodpeckers on the 200,000-acre Savannah River Site, a federal nuclear facility on the Georgia/South Carolina border. Ironically, the species' decline has more to do with logging and Mother Nature than with nuclear reactors.

Decades of clear-cutting the mature pines favored by the woodpecker for nesting decimated local populations. Also, hardwoods replaced the pines, and attracted such newcomers as flying squirrels, which took over tree cavities and drove the woodpeckers away.

Dotted with glistening ponds and ancient cypress trees, the Southeast's pine forests have been a home to the red-cockaded woodpecker for thousands of years. In 1986, the Forest Service and the University of Georgia's Savannah River Ecology Lab began luring the endangered woodpecker back. USFS workers live-trapped 15 birds from densely inhabited regions and trucked

them to the Savannah site. Here, they've built 33 nesting cavities in younger pines typically too dense for woodpeckers to penetrate. USFS workers also trim hardwood growth, allowing pine trees to fully mature.

Today, 25 red-cockaded woodpeckers call the Savannah River Site home — impressive considering that nesting pairs produce just two or three woodpeckers a year. Already, the project is inspiring similar woodpecker-restoration efforts in other parts of the Southeast.

— *Ginia Bellafante*



To help restore the endangered red-cockaded woodpecker, a worker saws into a pine tree and slips a nesting box into the cavity.

ALL PHOTOS: PETER STANGEL